THE
ELECTRICAL REVIEW

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Contents

	Page
Editorial — Overhead Lines — and Bombs	255
Water Turbine Developments. By F. Johnstone Taylor	257
Transformer Overloads. By C. Anderson, A.M.I.E.E.	259
Viaduct Cable Crossing	261
Personal and Social	262
Integrating Steam Consumption. By R. C. Golding, M.Sc.(Eng.), A.M.I.E.E.	263
Convection Reflector Heater. By J. L. Gaved	264
Farm Supplies. By A. Stewart	265
Generator Cooling	266
Commercial and Industrial	267
Activity in Malaya	269
Electricity Supply	270
Financial Section	271
New Patents	273
Contract Information	274

Classified Advertisements (Official Notices, Situations Vacant, etc.)	37
Index to Advertisers	56

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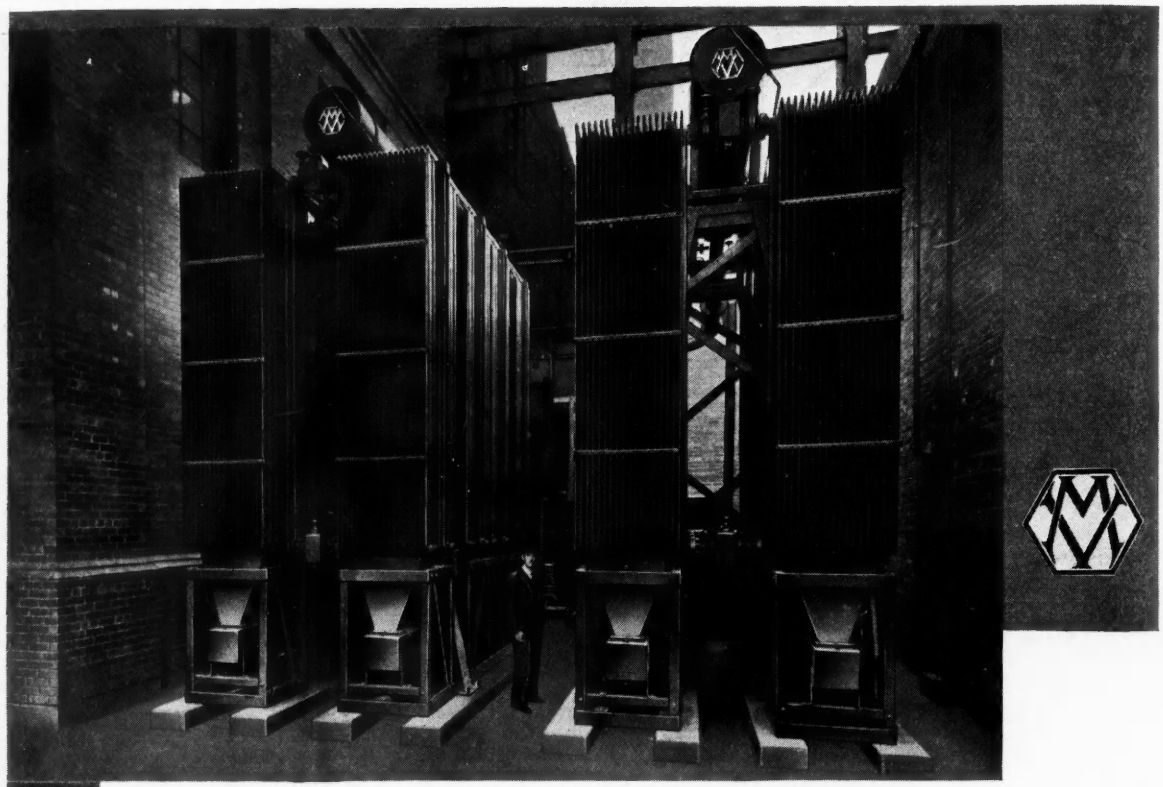
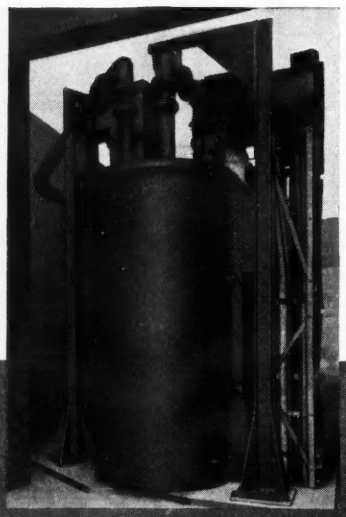


METROVICK TRANSFORMERS



The " Metrovick " 62,500 kVA Generator Transformer installed at a large Power Station.

The upper photograph shows the cooling equipment for type ON/OFB cooling.

The smaller photograph is viewed from the inner end of the cubicle showing the 33 kV Cable Box and entering cables on the right, and 11 kV Cable Box on the left.

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THE
ELECTRICAL REVIEW

THE OLDEST ELECTRICAL PAPER — ESTABLISHED 1872

Vol. CXXVII. No. 3279 SEPTEMBER 27, 1940 Price SIXPENCE

Overhead Lines—and Bombs

Lessons from recent experiences

THE lot of a distribution engineer in peacetime is never a sinecure, whether he be in town or in a rural area. Probably the man in the rural area has the harder time as he has overhead lines to look after and is accustomed to a continual fight against nature in the form of birds, high winds, thunderstorms and the like. The risk of aerial bombardment has now to be added to the list. The effects of high-explosive and incendiary bombs on overhead lines can only be known as the result of experience. While they can be more easily and quickly patched up than can underground cables, the amount of damage sustained is probably more than was anticipated by many undertakings when spares were being ordered and stored. Evidence of a comprehensive character is, naturally in the circumstances, difficult to come by and instances, for very good reasons, may not be particularised, but useful inferences may be drawn from such details as are so far available.

From information sent us by engineers who have recently suffered from aerial bombardment, it appears that conductors have suffered more severely than any other overhead transmission component. Cross-sectional area appears unimportant, as all sizes seem to have received similar damage under similar conditions. Conductors have been cut totally or partly through by bomb splinters or sharp stones from high-explosive bombs up to about 100 lb. at distances up to about 100 yd. from the line. In one case reported a 33-kV double circuit 0.1 sq. in. line had several conductors down over a length of seven spans due to the explosion of a 1,000-lb. bomb some 120 yd. away.

Copper shows up to Advantage

Low-voltage lines are reported to have suffered more from falling or flying debris than from bomb splinters, damage being localised as a rule. So far we have seen no evidence that blast is causing much trouble, except possibly in the blowing of high- and low-voltage fuses. The oil-canister type of incendiary bomb has, in several instances, burnt through conductors; from the small crater that it forms black oil may be splashed to a radius of 20 ft. Most of the heat developed seems to rise vertically and with sufficient intensity to burn through copper conductors up to 0.06 sq. in.

Copper conductors have shown to better advantage than aluminium; they seem less prone to damage and are more quickly and cheaply repaired. It has been found possible, by careful workmanship, to draw together the two ends of a severed aluminium steel-core conductor and to joint them with a cone-grip mechanical joint without materially upsetting the sag of the conductor. This has been done on long spans even when the intermediate cross-arms have suffered damage due to their taking line tension suddenly in one direction. In very few cases have we heard of damage that has resulted in the severance of all conductors in a span.

Wood poles do not appear to have suffered much, in spite of their obvious ill-treatment when a conductor or conductors have been severed in mid-span. One case is on record of a bomb splinter of approximately 6 sq. in. area going completely through a pole (7½ in. in diameter at that point) about 2 ft. from the top, due to the explosion of a high-explosive bomb 50 yd. away. We have heard of no instances, so far, of a pole having been overturned due to blast; one bomb of small calibre exploded at the foot of an "A" pole without harming either pole or line.

Effects on Towers

Little important damage to steel towers is reported. Small fragments have been cut out of the tower legs and other ironwork by flying bomb splinters, and in one instance a direct hit on the stub by a high-explosive bomb of small calibre caused no trouble. Insulator damage has been surprisingly small, and the necessity for removal appears to be rare. Chips are to be found in plenty, but even disc-type strain sets seem to have borne a charmed life.

Lines fitted with stirrup-type binders have been repaired much more quickly than those having the ordinary "chicken" or side binder, because the former will take line tension on an intermediate pole, provided the pole ironwork stands up to it. This type of binder is used by our informant exclusively on "A" pole, single-circuit 11-kV lines with 0.1 sq. in. conductors and straight angle-iron cross-arms; in no case, it is stated, has trouble been experienced on the arm due to one conductor being severed and line tension being taken on the pin insulator.

Repairs have been carried out expeditiously in

spite of the often difficult and dangerous conditions of working. Judging by information received to date, there is every reason to believe that there need be little fear that so long as the supply industry is allowed to retain its linesmen, extensive shut-downs will be brought about by overhead-line damage due to aerial bombardment.

High-Frequency Furnaces

As a result of the increased demand for special alloy steels in present circumstances, the merits of the high-frequency induction furnace are likely to be more and more appreciated. There is a point that needs to be watched, however, and that is the possibility of the failure of the crucible lining resulting in the ingress of water at perhaps 100 lb. per sq. in. pressure with consequent expulsion of molten metal. Such failures may be rare, but they have nevertheless to be guarded against. Reference was made in a recent issue of "Electrical Accidents" (the annual survey made by the Electrical Branch of the Home Office) to the development of automatic electric signals which would give sufficient warning to prevent accidents of this kind. Regular tests need to be made on such devices under working conditions and a desirable adjunct would be automatic equipment for shutting down the plant if necessary to avoid danger. A useful line of research would be in the direction of improving the mechanical properties of basic refractory linings and inductor-coil construction.

Klip Station

RESULTS are now to hand of the second year's working of the new Klip generating station built by the Electricity Supply Commission of South Africa for supplying the gold mines on the Witwatersrand. During 1939 the plant was brought almost to its full capacity of 396,000 kW, one further 33,000-kW set being in course of construction. For a station with an output of over 2,000 million kWh at a load factor of 71 per cent. a fuel consumption of 1.71 lb. per kWh sent out would, at first glance, seem disappointing. However, the coal has a calorific value of only 9,420 BThU per lb., so that the overall thermal efficiency is rather more than 21 per cent. When comparing this performance with the results achieved by the more modern British stations, it should be noted that the cost of coal at Klip is 3s. 8d. per ton, and the choice of 390 lb. per sq. in. steam pressure provides an indication of the policy adopted. As in the case of the older Witbank station, where coal is obtained for 2s. 3d. per ton, it has not been considered sound economically to pay the price of the highest thermal efficiency, as it has been in Great Britain with its relatively expensive fuel.

Portable Tools

So much work is being carried out just now of a temporary nature involving the use of portable tools, that checks on methods of securing safety by direct earthing assume more than usual importance. A principal difficulty is that no automatic indication of a break in the earthing conductor is given as it is in the case when either of the power conductors are open-circuited, which causes the motor to stop. An effective safeguard against the user being let down by a false sense of security due to the presence of an earth connection is a device recommended by the Home Office. In this the supply to the tool is controlled by a contactor having a low-voltage operating coil in circuit with the earth wire and a fourth conductor in the flexible, the loop being completed by a press-switch on the tool. By this means a break in either of these conductors will result in the power current being cut off. A simpler method is to rig up a test panel with a three-pin socket. Only the earth contact is wired up—to earth and also to a lamp in series with a dry battery, the other pole of which is taken to a test contact on which the frame of the tool can be touched. If the circuit is sound the lamp lights. This method, however, does not protect the user against the illusive intermittent earth. The best way of ensuring freedom from serious shock is, of course, by employing low voltages for portable apparatus, but this unfortunately is not always practicable in workshop conditions.

Industrial Accidents

INCREASING mechanisation of industry has been accompanied by a greater accident risk to workers, and the risk is certainly not likely to be less with the strenuous efforts to speed up production that the present crisis enjoins. During recent years much has been done by legislation, safety organisations and other means to counteract the risk. Occupying a high place among the "other means" is the Home Office Industrial Museum, which is visited each year by more than 15,000 factory owners, works managers and others whose interest it is to promote safety in industry. The value of the Museum does not consist only in displaying examples of simple precautions that can be adopted without undue expense; more important, perhaps, is the idea it inculcates in the minds of responsible persons that it is their job to take the initiative in making sure that their plant is safe without waiting for a visit from the Factory Inspector. It is to be regretted that it was found necessary to close the Museum at the outbreak of war, as its influence has an immediately practical bearing.

Space Heating

PANEL heating, which originated in this country, is now becoming popular in the United States, and *Power*, in recording this tendency, gives due credit to Mr. A. H. Barker as its pioneer. The object of this system is to apportion the thermal losses of the human body in such a way as to give the greatest comfort, the optimum condition generally being 190 BThU per hour by radiation and 110 by convection. Of the remainder making up the average hourly loss of 400 BThU, 60 BThU goes in evaporating surface moisture and 40 BThU in air exhaled from lungs and body wastes. When the loss by radiation is unduly high in a hot atmosphere a sensation of stuffiness results, whereas when radiation is restricted to a desirable quota the amount of heat carried off by convection in cooler air gives a feeling of freshness although the total heat loss is the same in each case. We have come across many well-designed electric panel heating installations that bear out this contention in practice.

Hydro-electric Costs

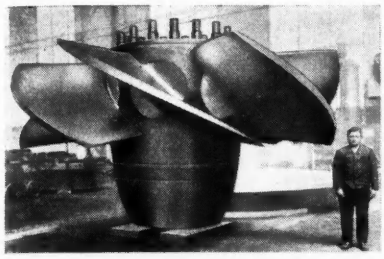
ALTHOUGH the proportion of hydro-electric plant to the total installed in the United States has increased approximately from 25 per cent. in 1920 to 28 per cent. in 1939, the corresponding kWh percentages were, *Power* states, about 37 and 34. Much of the anomaly may be attributed to subnormal rainfall last year, but in any case the figures illustrate the need to allow for the possible need to provide steam stand-by or supplementary plant when comparing the costs of water-power and coal schemes. Thus the T.V.A., with 926,000 kW of hydro-plant and 260,000 kW of steam plant installed, has applied to Congress for funds to build a new 120,000-kW steam station.

WATER TURBINE DEVELOPMENTS

Hydro Electricity from High and Low Falls

By F. Johnstone Taylor

WHILE there is no strict line of demarcation between high, medium and low falls, most of the present work comes into the second category where the operating head is between, say, 100 and 300 ft. Heads of over 1,000 ft. introduce some difficult pipe-line problems, but even then they are usually the cheapest to develop. The major problems arise when the fall is below 50 ft. With a larger volume of water for a given output, the incidental works usually involve a barrage, sluices, a supply canal and perhaps a heavy bulkhead construction at the power house.

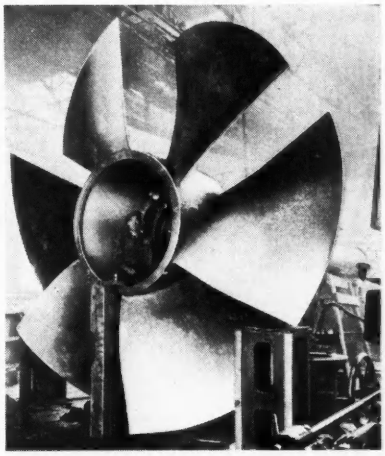


Runner of a 30,000-HP Voith-Kaplan turbine for the Shannon Scheme

The ideal machine for low-fall conditions would be a parallel flow one, as Jonval discovered many years ago when he designed a vertical-shaft turbine with the guides on top of the wheel. Working at very low speed and incapable of any close speed regulation, it proved unsuitable to modern hydro-electric work. With the screw pump in mind, Nagler and Moody in the United States and Dubs, Lawaczeck, Prasil and Laufrad in Europe all worked on pretty well the same lines in the evolution of a turbine retaining the Francis guide-control system, but having an axial-flow runner of screw form. Thus was evolved a compact and comparatively simple machine for open settings. Those made for the Shannon station with a normal output of 30,000 HP at 175 RPM on a head of about 85 ft. are Kaplan turbines with adjustable blades, but this does not affect the installation as a whole as it would be almost identical with a fixed blade runner.

Apart from modern Kaplan turbines, the main purpose of the propeller-type runner is to obtain a higher speed with more convenient dimensions than with a Francis runner. In order to obtain the highest values of specific speed, both the surface area of the runner vanes and the velocity of the flow must be kept as small as possible. As the height of the vane at entry becomes equal to its inlet diameter the specific speed is increased since a greater volume of water can be made to pass through the turbine at low velocity. The surface area is also increased, however, and in order to realise still higher specific speeds there must be an increase in both the runner-vane entry angle and the guide-vane angle, but the designer then comes up against practical difficulties in that a large guide-vane angle makes regulation difficult, while a small one leads to excessive draft-tube loss and a high exit velocity with excessive suction leading to cavitation and its attendant destructive effect on the runner. In some instances it has been found best to locate the runner at either a very small elevation above tail water level or occasionally even below it.

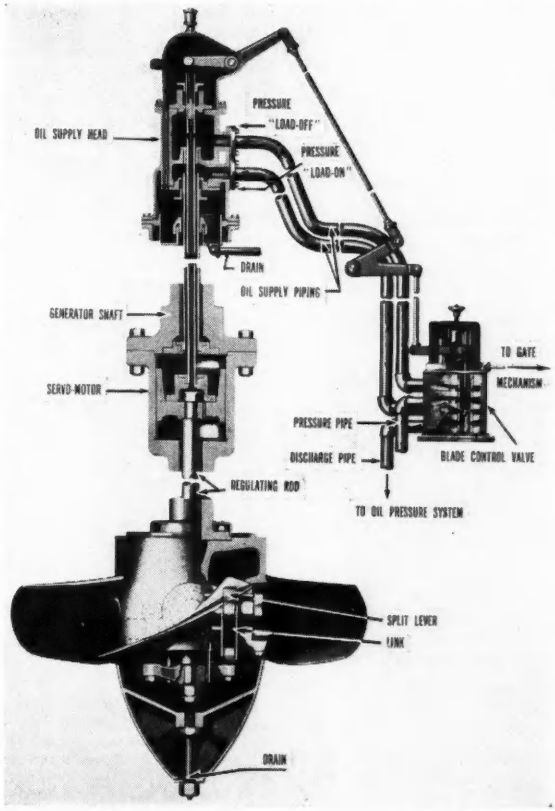
Again the actual form of the runner blades varies. Some are like a multi-bladed ship's propeller at one time favoured by American designers; others like the Laufrad are more like a fan; the Lawaczeck design has almost straight downwardly directed blades which have great strength while the Prasil runner is helical in form. For the most part, however, propeller turbines of recent date have four- or five-bladed impellers.



Typical propeller type runner (37,500 - HP, Seven Sisters Development, Manitoba)

Compared with the runner of a Francis turbine, which for the power developed under a given set of conditions would be larger and heavier they obviously present a much simpler foundry problem. The ability to machine the blades is a further advantage, though the fixed-bladed machine has not necessarily a high efficiency, as the blade angle is normally fixed for one head and when this varies the efficiency falls off.

Where seasonal variation is anticipated, the runner blades are sometimes separately cast and fitted to the hub in such a manner that the angle is adjustable. Such an arrangement widens the scope of this comparatively cheap construction, though in the majority of the larger low-fall plants of the last decade some of the units have been either Francis machines, as at the Shannon works, or fixed-bladed propeller-type units or Kaplan turbines with a runner blade angle adjustable by the governor.



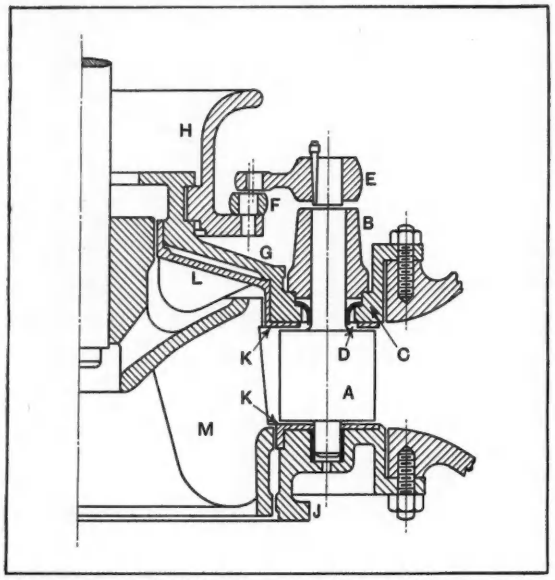
Control system of Kaplan turbine

Kaplan Turbines

Such builders as the European firms of Voith and Escher Wyss and the American concerns of I. P. Morris and Morgan Smith have built large numbers of Kaplan turbines, mostly

for such works as the Wheeler Dam and the Norris Dam and Safe Harbour schemes in America, the Svir works in Russia and the somewhat older scheme at Lilla Edet in Sweden, where the Kaplan turbine of large output first came into prominence by demonstrating its value when working along with fixed-blade machines. Nevertheless, it is not only applicable to large plants such as the Shannon works with individual machines which have capacities averaging round 40,000 HP.

Amongst industrial concerns, the Great Northern Paper Co., of Millinocket, Maine, has recently put down two 5,900-HP sets operating with two fixed-bladed runner sets of similar power and operating on 39 ft. head at the comparatively high speed of 171.4 RPM. The Kaplan turbine is not as complicated as is sometimes assumed, though the construction is costly. Its four, five or even seven blades are pivoted in the hub and connected to a crosshead which is moved by the piston in a servo-motor, thus altering the blade angle by an amount determined by the governor. Thus the latter not only controls the speed but auto-



A—Guide Vanes. B—Guide Vanes Bearing. C—Sealing Cup. D—Bronze Thrust Ring. E—Guide Vane Lever. F—Link. G—Turbine Cover. H—Regulating Ring. I—Guide Wheel Ring. K—Wearing Rings. L—Cover Protection Disc. M—Runner.

Guide vane system (Voith)

matically keeps the turbine working at the highest efficiency at the same time.

High-Head Machines

As regards Francis turbines of the cased type with a horizontal shaft for high-head work, practice formerly inclined to the use of double-discharge runners, but is now rather more towards single-discharge machines with overhung runners, two being coupled to one generator. Thus, with a comparatively short, stiff shaft a machine with good axial balance can be built which is compact and capable of close speed regulation and which has a high efficiency and an accessible guide system.

The three turbines at present installed for the Cauvery Mettur project (India), which is connected to the Pykara system, are of 16,000 HP each running at 250 RPM. They have stainless steel runners, but principal interest in them centres in the fabrication of the entire spiral casing by welding from steel plate, while the speed ring is of cast steel. Both are in halves joined by flanges, rigidity and correct alignment being secured by mounting the casing on a U-shaped bedplate which carries the alternator bearing pedestal, this bedplate and much of the bottom half of the casing being buried in concrete.

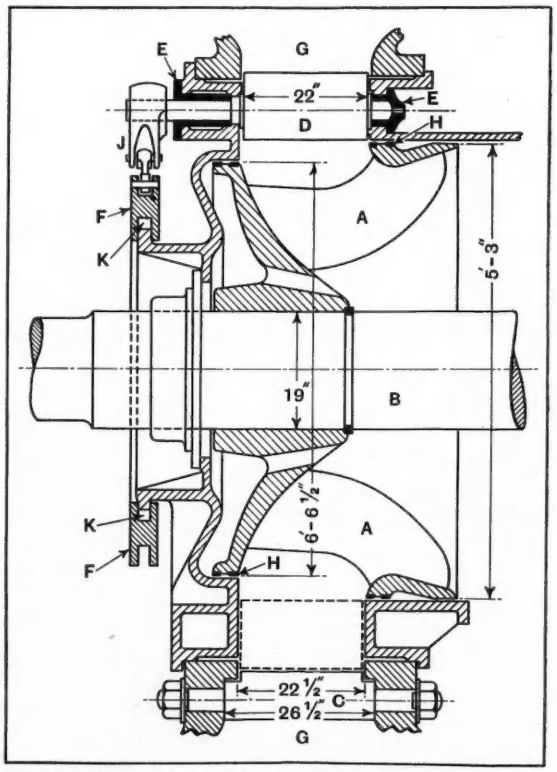
In recent designs the gate apparatus consists of stainless steel gates cast integral with their stems, which are protected by special collars. When closed, they make contact with each other along machined bearing strips so as to be as nearly drop-tight as possible. The connecting gear between the gates and the ring is " offset "—an arrangement that reduces the regulating energy by making the volume of water admitted or shut off proportional to the governor stroke. The cast-iron links and levers which couple the gates to the regulating ring are designed to fracture if any part of the guide system jams.

Pelton Wheels

At or around 250 ft. head and in some cases even less, the Pelton wheel becomes an attractive proposition, though as heads between about 200 and 700 ft. are suitable for both Pelton wheels and cased Francis machines, the decision is dependent upon local considerations. In many respects the simpler machine, the impulse turbine, may not for a given set of conditions be either the most suitable or the cheaper one. Also, generally speaking, its efficiency is slightly lower.

Apart from the present-day practice of casting the buckets of Pelton wheels from stainless steel, sometimes singly and sometimes in pairs, and giving them a high polish, as was recently done by Firths for some large units built by Bovings (17,000 HP on 1,900 ft. head at 430 RPM) for the Shanan (Punjaub) works, few notable innovations have been made in the design of Pelton wheels during the last decade. The tendency, as with horizontal-shaft cased Francis machines for similar head conditions, is towards the employment of overhung runners on the generator shaft, and some German steelworks have been successful in casting steel runners integral with the buckets.

A new development is in the employment of multi-nozzle vertical-shaft turbines of this class. Because a vertical-shaft machine has certain mechanical disadvantages, not the least of which is the necessity for carrying a heavy rotating load on a costly thrust bearing, it might at first be argued that this was a retrograde step as such machines are not new either in conception or in practice, but it actually facilitates, under certain circumstances, the building of a high-power impulse turbine relatively cheaply with only one wheel. Twin-runner units, especially when built like the above-mentioned sets with the runners overhung, are a relatively simple mechanical problem.



A—Runner (Stainless Steel). B—Shaft (Hollow). C—Stay Vanes. D—Guide Vanes (Steel). E—Grease Lubricated Bushes. F—Regulating Ring. G—Spiral Casing. H—Copper Sealing Strips. J—Links. K—Roller Train.

Guide and wheel system, 24,000-HP, 300-RPM double-runner turbine (Boving)

When the wheel is mounted vertically, there is no difficulty with interference if there are four nozzles, and a single-runner turbine of this class is the equal in power of a twin-runner double-nozzle unit using the same volume of water under the same head conditions. Five three-nozzle

(*Concluded at foot of next page*)

TRANSFORMER OVERLOADS

Calculating Permissible Sustained Values

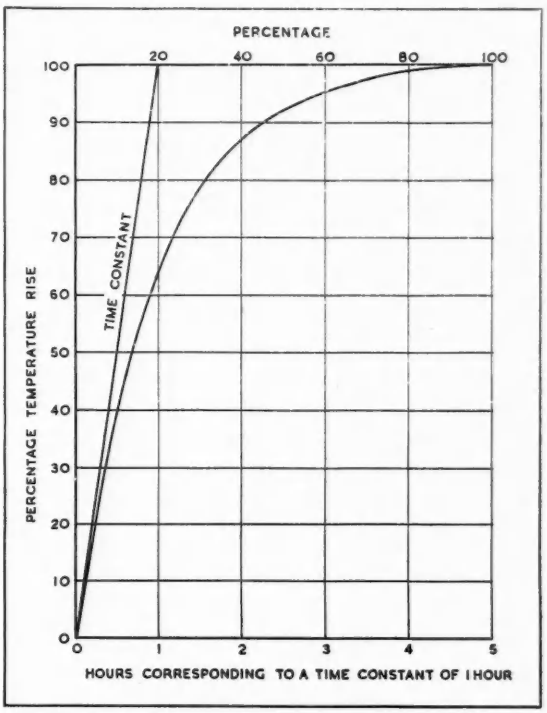
By C. Anderson, A.M.I.E.E.*

THE current edition of the British Standard Specification for the Electrical Performance of Transformers (No. 171, 1936), deals more fully with sustained overloads, under various conditions of load and ambient temperatures, than did its predecessor. Even so, as it is of general application, it is only approximate in particular cases. From the various functions and constants for oil-immersed transformers stated, however, the overloads for any given transformer can be calculated.

The Specification requires that the average temperature rise, measured by increase of resistance of the windings, shall not exceed 60 deg. C. above the ambient air temperature for an oil-immersed naturally-cooled transformer. The ambient air temperature is given as 40 deg. C. peak value, and an average value of 35 deg. over twenty-four hour periods so that, at the peak ambient temperature, the average temperature the windings may attain is 100 deg. As the permissible rise in oil temperature is 50 deg. the corresponding total temperatures are 90 and 85 deg. C. There is, therefore, a 10 deg. gradient between the winding and the oil under continuous maximum rating conditions.

The load carrying capacity of a transformer is limited only by temperature, and so long as this is kept within prescribed limits no damage is incurred. The high temperature to which insulation can now be subjected without damage is not generally appreciated, perhaps due to the use in this country of two temperature scales, Fahrenheit and Centigrade. For instance, it may not be at once realised that the average winding temperature of a transformer on full load, with the maximum allowable ambient air temperature, is 212 deg. F., or the boiling point of water. Moreover, the transformer is perfectly safe at this temperature and with the slight reduction of 9 deg. F. (5 deg. C.) in the average ambient air temperature over twenty-four hours can be run continuously under these conditions.

The reason such temperatures are not usually experienced is that the ambient air temperature in this country rarely reaches the maximum of 40 deg. C. specified. Full load on many transformers is reached only in the winter months when the ambient air temperature is low. For instance, the maximum air temperature registered at Barton Airport October 1st, 1935, and March 31st, 1936, was 18 deg. C. Thus there was a margin during that period of at least $40 - 18 = 22$ deg. C. in the ambient air temperature, which could have been utilised for overloads on the transformer.



Curve showing time taken to reach any particular percentage of the final temperature rise for a transformer having [a one-hour time constant

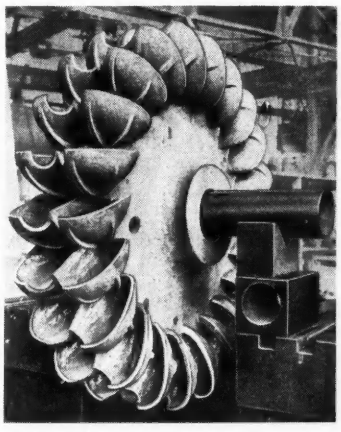
Take the case of a sub-station with a maximum summer demand of 1,000 kVA, rising in the winter months to 1,300 kVA between 4.30 and 6 p.m. It might be considered necessary to install a 1,500-kVA transformer. Actually a 1,000-kVA transformer would be ample. In fact, assuming an average air temperature of 15 deg. C. (the maximum registered at Barton between December 1st, 1936, and January 31st, 1937, was 13.4 deg.), an overload of 40 per cent. could be safely carried for 1½ hours after operation on full load continuously. By taking advantage of this overload capacity, one could reduce considerably the capital outlay on the transformer, provided that the increased regulation and the capacities of the associated cables and switchgear permitted it.

The following two formulæ relating to temperature are given on page 24 of B.S.S. 171 :—Temperature rise of oil above air temperature at normal full load = temperature rise of oil during test $\times \left(\frac{W_n}{W_t}\right)^p$ .... I, and temperature difference between winding and oil at normal load (temperature gradient) = temperature difference at load during test $\times \left(\frac{I_n}{I_t}\right)^q$ .... II, where W_n and W_t = total losses in watts at normal load and at load during test, I_n and I_t = currents at normal load and at load during test, $p = 0.75$ and $q = 1.5$ for ON transformers.

* Chief Assistant Engineer, Douglas (I.O.M.) Electricity Department

Water Turbine Developments *(Concluded from preceding page)*

units were recently built by Boving's Swedish associates for the Rio Cinca plant at Bilbao, Spain, rated at 20,500 HP on 1,500 ft. head at 500 RPM. Almost the same arrangement is made use of in another plant of the same development in which the turbines have four jets and are rated at 30,000HP on 1,120ft. head at 428 RPM. They have stainless steel buckets cast in pairs and the spear-cum-deflector system of governing.



Cast-steel Pelton wheel with integral buckets

Escher Wyss-Metrovick sets of 18,600 HP at Maipo, Chile, are working on a head of 670 ft. and Escher Wyss sets at the Handeck power station of the Oberhasli Power Co. develop 30,000 HP on 1,750 ft. head at 500 RPM. In the case of the Maipo sets, the distributing pipe, which is on the same level as the runner wheel, is of spiral form and its inner periphery has four inlets each equipped with a needle valve, the spiral serving as a base for the whole turbo-generator set with which it is connected by means of a cast-iron yoke.

From these formulæ the final temperature rise and gradient may be calculated for any particular load. Table I gives the value of these between 100 and 200 per cent. of normal full load, with various ratios of no-load to full-load losses, calculated from the formulæ. This table applies to all oil-immersed transformers having loss ratios as stated and it will be noticed that the difference in the final temperature rise for the three loss ratios given is quite small. Any particular case, however, could be calculated directly from the formulæ.

TABLE I

Extent of Loading Per Cent. Full Load	Temp. Gradient ° C	Final Temperature Rise					
		Loss Ratio 2 : 1		Loss Ratio 3 : 1		Loss Ratio 4 : 1	
		Ratio	Rise ° C	Ratio	Rise ° C	Ratio	Rise ° C
100	10	2.0 : 1	50	3.0 : 1	50	4.0 : 1	50
110	11.5	2.42 : 1	55.2	3.63 : 1	55.8	4.84 : 1	56.2
120	13.2	2.88 : 1	60.7	4.32 : 1	62.4	5.76 : 1	62.8
130	14.8	3.38 : 1	66.5	5.07 : 1	68.4	6.76 : 1	69.5
150	18.3	4.5 : 1	78.8	6.75 : 1	82.2	9.0 : 1	84.2
175	23.2	6.13 : 1	95.9	9.18 : 1	100.6	12.25 : 1	103.8
200	28.4	8.0 : 1	113.8	12.0 : 1	121	16.0 : 1	125

As a typical example, find the final temperature rise of oil and windings at 20 per cent. overload continuously for a 500-kVA transformer with a no-load loss of 2,000 W and a full-load copper loss of 7,000 W. Total loss at normal full load (W_n) = 2,000 + 7,000 = 9,000 W. At any other load, the no-load loss will, of course, remain constant and the copper loss will vary as the square of the load, thus :—

Total loss at 20 per cent. overload (W_t) = 2,000 + (7,000 × 1.2²) = 12,080 W ; final temperature rise of oil at 20 per cent. overload = $\dfrac{\text{temperature rise at full load}}{\left(\dfrac{W_n}{W_t}\right)^{0.75}}$

$= \dfrac{50}{\left(\dfrac{9,000}{12,080}\right)^{0.75}} =$ 62.5 deg. C.

Temperature gradient at 20 per cent. overload = $\dfrac{\text{temperature gradient at full load}}{\left(\dfrac{I_n}{I_t}\right)^{1.5}} = \dfrac{10}{\left(\dfrac{1}{1.2}\right)^{1.5}} = 13.2$ deg. C. Final temperature rise of windings at 20 per cent. overload = final temperature rise of oil at 20 per cent. overload + temperature gradient at 20 per cent. overload = 62.5 + 13.2 = 75.7 deg. C.

As the winding temperature is allowed to be 95 deg. with an average ambient air temperature of 35 deg. C. and the gradient between the winding and the oil is known, the allowable oil temperature rise above any other average ambient air temperature can be found. Taking for example a 25 deg. C. average ambient air temperature and a loss ratio of 3 : 1 the allowable oil temperature rise can be calculated for various overloads as shown in Table II.

TABLE II
AVERAGE AMBIENT AIR TEMP. 25° C

Extent of Loading Per Cent. Full Load	Allowable Oil Temp. ° C	Allowable Oil Temp. Rise ° C
100	95 − 10 = 85	85 − 25 = 60
110	95 − 11.51 = 83.5	83.5 − 25 = 58.5
120	95 − 13.2 = 81.8	81.8 − 25 = 56.8
130	95 − 14.8 = 80.2	80.2 − 25 = 55.2
150	95 − 18.3 = 76.7	76.7 − 25 = 51.7
175	95 − 23.2 = 71.8	71.8 − 25 = 46.8
200	95 − 28.4 = 66.6	66.6 − 25 = 41.6

The period during which an overload can be sustained can be derived from the curve reproduced from B.S.S. 171, showing the time taken to reach any particular percentage of the final temperature rise for a transformer having a one-hour time constant. For example, referring to Table II, the allowable oil temperature rise at 20 per cent. overload is 56.8 deg. C. Should the transformer be allowed to carry this overload continuously, the final oil temperature rise for a 3 : 1 ratio transformer (Table I) would be 62.4 deg. C., corresponding to 100 per cent. temperature rise on the heating curve ; this would be reached in five hours with a one-hour time constant transformer.

The allowable temperature rise of 56.8 deg. C. is 91.2 per cent. of the final temperature rise. Referring to the heating curve this corresponds to a period of 142 min. which is the period for which the overload could be sustained under these conditions. In Table III the permissible

TABLE III
AVERAGE AMBIENT AIR TEMP. 25° C

Extent of Loading Per Cent. Full Load	Allowable Temp. Rise as Percentage of Final Rise	Allowable Overload Period (Minutes)
100	120	Continuous
110	105	Continuous
120	91.2	142
130	80.8	96
150	62.9	58
175	46.5	37
200	34.4	24

periods of various overloads are stated for a loss ratio of 3 : 1.

If the transformer is already energised but not supplying any load, the oil temperature will have risen due to the no-load losses by an amount that can be calculated by means of formula I. Again, assuming a loss ratio of 3 : 1 and an average ambient air temperature of 25 deg. C., the following expression is obtained :—Temperature rise of oil due to no-load loss = $\dfrac{\text{temperature rise at full load}}{\left(\dfrac{\text{total loss}}{\text{no-load loss}}\right)^{0.75}}$

$= \dfrac{50}{\left(\dfrac{4}{1}\right)^{0.75}} = 17.7$ deg. C.

Thus the allowable temperature rise at 20 per cent. overload of a transformer already energised would be 56.8 − 17.7 = 39.1 deg. C. and the final temperature rise 62.4 − 17.7 = 44.7 deg. C. The allowable rise would therefore be 87.5 per cent. of the final rise corresponding (in the figure) to a sustained overload period of 122 min. (Table IV).

TABLE IV
AVERAGE AMBIENT AIR TEMP. 25° C

Extent of Loading Per Cent. Full Load	Allowable Temp. Rise Above No Load Rise	Final Temp. Rise Above No Load Rise	Allowable Temp. Rise as Per Cent. of Final Temp. Rise	Allowable Period of Overload (Minutes)
100	42.3	32.3	131	Continuous
110	40.8	38.1	107	Continuous
120	39.1	44.7	87.5	122
130	37.5	50.7	74	79
150	34	64.5	52.7	44
175	29.1	82.9	35.1	25
200	23.9	103.3	23.1	16

The allowable period of overload can also be calculated for a transformer which has been operating continuously at its nominal full-load rating. In this case the allowable temperature rise, at 20 per cent. overload would be 56.8 − 50 = 6.8 deg. C. and the final temperature rise above the full-load rise 62.4 − 50 = 12.4 deg.. Thus the allowable rise would be 55 per cent. of the final rise and corresponding to an overload period of 47 min.

In the foregoing it has been assumed that the gradient (or difference between the winding and oil temperatures) has reached its final value, but this also takes time to establish itself. The effect of this is seen in the two highest overloads in Table V, where the allowable temperature rise

TABLE V
AVERAGE AMBIENT AIR TEMP. 25° C

Extent of Loading Per cent. Full Load	Allowable Temp. Rise Above Full Load Rise	Final Temp. Rise Above Full Load Rise	Allowable Temp. Rise as Per Cent. of Final Temp. Rise	Allowable Period of Overload (Minutes)
100	10	0	8	Continuous
110	8.5	5.8	146	Continuous
120	6.8	12.4	55	47
130	5.2	18.4	28	20
150	1.7	32.2	5	3
175	− 3.2	50.7	—	—
200	− 8.4	71	—	—

is shown to be less than the full-load temperature rise, due to the incorrect assumption that the gradient has reached its final value. In order to obtain the correct period of overload it is necessary to find how the loading affects the gradient. Assuming the copper is rated at 7 W per lb., the rise in temperature, with no heat dissipation, is 0.04 deg.

per sec., since 175 W will raise the temperature of 1 lb. of copper 1 deg. C. in one second. At normal full load the gradient is 10 deg. C. so the time constant for the copper is $\frac{10}{0.04} = 250$ sec. The heating curve shows that the period to reach the final temperature rise is five times that

TABLE Va
AVERAGE AMBIENT AIR TEMP. 25° C

Extent of Loading Per Cent. Full Load	Allowable Period of Overload (Minutes)
150	7.5
175	3.9
200	2.6

of the time constant. As the gradient will follow the same law, the period for this to become established will be 5×250 sec. $= 20.8$ min. Periods for various loadings are given in Table VI.

Comparing these with the overload periods calculated in the previous tables, it will be noticed that with the exception of the three highest overloads in Table V, the gradient has had time to establish itself. Of these, taking for example the 150 per cent. loading, the allowable period of overload is given as 3 min. According to Table IV, however, the gradient is not established for 17 min. The true overload period must, therefore, be longer than that calculated.

TABLE VI

Extent of Loading Per Cent. Full Load	Gradient ° C	Watts/lb.	Temp. Rise Per Second ° C	Time Constant (Seconds)	Period to Establish Gradient (Minutes)
100	10	7.0	0.04	250	20.8
110	11.5	8.46	0.0485	238	19.8
120	13.2	10.1	0.058	227	18.9
130	14.8	11.82	0.068	218	18.2
150	18.3	15.75	0.09	204	17.0
175	23.2	21.5	0.123	188	15.7
200	28.4	28	0.16	177	14.8

Applying the hour scale of the heating curve to the gradient, the five-hour point corresponds to the time taken to establish the gradient, *i.e.*, 17 min. in the example taken. Regarding this point as 100 per cent. and assuming a value of the true overload period on a " trial and error " basis—say 7.5 min.—this is 44 per cent. of 17 min. Reading this on the hour scale of the heating curve the corresponding percentage temperature rise is found to be 89.5. The final value of the gradient at 150 per cent. load is 18.4 deg. C. and 89.5 per cent. of this is 16.5 deg., which is the value to which the gradient will rise in 7.5 min. The allowable oil temperature rise will then be $95 - (16.5 + 25 + 50) = 3.5$ deg. The allowable temperature rise is therefore 10.9 per cent. of the final temperature rise and from the heating curve this represents an overload period of 7.5 min. The three highest overloads in Table V have been corrected in this manner and the results are given in Table Va.

All the foregoing values are based on one-hour time constant transformers, and must be multiplied by the time constant of other transformers, as given in B.S.S. 171. The overload period can thus be obtained for any normal size or type of transformer.

With natural air-cooled oil-immersed transformers, the rating of which has been increased by the addition of air blast or forced circulation in the cooling circuit, since the gradient also increases the allowable oil temperature rise must be adjusted accordingly. For example, if the rating is increased by 50 per cent. with the addition of air-blast cooling, the gradient will increase from 10 to 18.3 deg. C. (Table I). Thus the allowable oil temperature rise at the standard ambient temperature of 35 deg. will be $95 - (35 + 18.3) = 41.7$ deg. C., and not the normal rise of 50 deg. as is sometimes assumed.

In the case of forced circulation the reduction in oil temperature rise is less, due to an increase of 5 deg. in the winding temperature rise allowed by B.S.S. 171. Assuming the same example for this case, the allowable oil temperature rise would be $100 - (35 + 18.3) = 46.7$ deg. C. The reduction in allowable oil temperature rise is thus quite appreciable and in adopting such a scheme the altered conditions should be carefully calculated.

VIADUCT CABLE CROSSING

Interesting Canadian Experiment

RECENTLY the British Columbia Electric Railway Co. was faced with the necessity of providing additional 2,300-V feeder capacity from its Main Street sub-station to the rapidly expanding shopping area in Granville Street. The direct route lay over the Georgia Viaduct, a steel and reinforced-concrete structure built in 1914 and having a length of 2,600 ft. Cable ducts, which had been laid in the side walk when the span was built, were unsuited to accommodating large multi-conductor lead-covered cables. (The Underground Systems Committee of the Canadian Electrical Association has recently issued a report regarding the methods adopted in utilising these ducts.) Manholes in the concrete sidewalk were of relatively small floor area and shallow. They were long enough to take lead-sleeve splices on three-conductor cables, but gave insufficient room for a bend in addition, which was required to protect the lead from circumferential cracks due to longitudinal movements caused by expansion or contraction of the viaduct with temperature changes.

The use of rubber insulation without a lead sheath in the manholes was considered, but it was finally decided to use single-conductor, paper-insulated and lead-covered cables in the viaduct section. This type of cable not only required a much shorter joint than a three-conductor cable, but owing to its smaller diameter it permitted bends to be accommodated in the manhole.

Fibre ducts available had an internal diameter of 4 in. and the average spacing of the manholes was 400 ft., the longest section being 521 ft. Although the viaduct sidewalks are exposed to the sun, the maximum circuit loading was mainly due to commercial lighting which was unlikely to coincide with the highest ambient temperatures. Conductors of 450,000 cir. mil section were therefore chosen, which enabled the three single-core cables to be pulled into one duct without difficulty, joints being made and a reasonable amount of slack cable accommodated in the manholes. At each end of the viaduct the three single-core cables were jointed to three-core cables with 500,000 cir. mil conductors as normally used by the company.

The lead sheaths of the single-core cables were bonded together and to the lead sheath of an existing three-core 12,000-V cable in an adjacent duct and connected at one end to a drainage cable.

After a few weeks one of the new single-conductor cables tripped out on overload. It was immediately re-energised and remained in normal service without further trouble until the next day, when inspection revealed a large hole burnt in the lead sheath on the underside within a few inches of the cable joint and extending for a considerable distance. The cable was taken out of service that night, the affected lead sheath removed and the insulation covered with a lead sleeve. The conductor was undamaged, but a small hole was burned through the insulation. This did not prevent the operation of the cable pending the location of the fault and the transference of the load to other circuits —a period of thirty-eight hours. The insulation fault was repaired by taping and none of the adjacent cables was injured.

WIRE-ROPE MANUFACTURE

TAR formed from a petroleum base and supplied in a semi-solid state provides an efficient medium for the lubrication of individual strands of wire-rope as well as for protection against corrosion and dirt. Difficulties in controlling the conditions of applying the tar at the correct temperature (270 deg. F.) led a wire-rope company in California to adopt for the purpose a welded rectangular tank 14 in. by 18 in. by 36 in. deep. This capacity is enough for one day's working. A 2.5-kW immersion heater was screwed in the bottom of the tank on each side of the 24-in. dipping sheave and controlled by a thermostat and magnetic switch. Handling of the compound is facilitated by pre-heating to 150 deg. F.

The requirement of 5 kW was arrived at as follows: Radiation at 270 deg. from the 20 sq. ft. surface of the tank plus 5 sq. ft. from the sheave amounts to $330 \times 25 = 8{,}250$ BThU per hour. To heat 5 lb. (maximum) of compound with a specific heat of 0.3 deg. F. calls for $5 \times 120 \times 0.3$ BThU per hour. Assuming a temperature rise in the strand of 100 deg. as a result of immersion in the hot compound and 640 lb. of steel with a specific heat of 0.125 going through the tank per hour, a further $640 \times 100 \times 0.125 = 8{,}000$ BThU is needed, making the total 16,430 BThU per hour.

PERSONAL AND SOCIAL

Information regarding new appointments and other matters of interest for this page are welcomed

THE Minister of Supply has appointed **Mr. G. C. Jenks**, J.P., M.I.Mech.E., chairman and managing director of the British Tool & Engineering Co., Ltd., Wolverhampton, to be Director of Hand Tools in the Department of the Director General of Equipment and Stores.

Ald. Joseph Morton, chairman of the Electricity Committee, has accepted an invitation to become Mayor of Stockport for the ensuing year.

Mr. G. Barnard, M.I.E.E., Callender's advisory director and engineer and manager in Central England, has recently completed fifty years of contract work for his company in connection with the

A recent picture of Mr. G. Barnard

Birmingham undertaking and many others in the Midlands. After working in Bath and in London he went to Birmingham in 1890, to start the first electricity supply mains system throughout the central part of the city for the Birmingham Electric Supply Co., before the undertaking was taken over by the City Council at the beginning of this century, of which latter company Sir Tom Callender was one of the founders. Mr. Barnard has had the unique experience of celebrating three golden jubilees during the last few years; the first in 1932 when he completed his fiftieth year of his joining Callender & Sons at Belvedere in 1882, the founders of the present company, and again in 1937 when he completed his fifty years on outside contract work in this country and abroad for them, one of his contracts being the carrying out of the first DC three-wire system in France, at Le Mans in 1887 and 1888. He has also carried out contracts in Germany and Italy. His third golden jubilee is the fiftieth anniversary of his connection with the Birmingham electricity undertaking.

Mr. Barnard was associated with the late Sir Tom Callender in putting down some of the early underground installations of mains in London from 1883 to 1886 before any company or municipal authorities had got their powers or Provisional Orders from Parliament under the 1882 Electric Lighting Act. Mr. Barnard represents the C.M.A. in the Central England Area of the Central Electricity Board.

Southport Electricity Committee has appointed **Mr. W. Rawnsley,** of Croydon, junior engineer in the Electricity Department at the commencing salary of £300 per annum, rising to £342 per annum.

Mr. F. Williams, of the staff of the G.E.C. telephone works, was married recently to **Miss Eunice M. Vercoe,** who has been senior demonstrator with the Coventry Corporation Electricity Department.

Mr. A. N. East, of the Electricity Commission, has been elected a Freeman of the City of London.

Mr. A. W. D. Cooper, of Bentham, has been appointed works manager with the Whitchurch (Hants) Gas and Electricity Co., Ltd.

Mr. G. H. D. Evans retired from the Borough of St. Marylebone Electricity Supply Department on September 13th, on completion of thirty-five years' service, during which period he has held successively the positions of meter superintendent, consumers' engineer and assistant mains and sales engineer.

Consequent upon the resignation of **Mr. E. Braathen,** technical assistant with the Hackney Borough Council Electricity Department, who has been appointed deputy chief engineer to the Stretford and District Electricity Board, the Hackney Council Establishment Committee has recommended that **Mr. G. Lee,** draughtsman, be appointed technical assistant at a salary of £464, rising to £482 per annum. The Committee also states that due to Mr. Lee's transfer greater responsibility will fall upon **Mr. E. C. Murray,** engineering draughtsman, and it recommends that he be designated assistant constructional engineer at a salary of £464, rising to £482 per annum.

Mr. R. J. Mayall, only son of Councillor J. W. Mayall, of Mayall & Co. Ltd., Birmingham, and past president of the Electrical Wholesalers' Federation, was married on September 17th to Miss Phyllis Mary Chew, of Sutton Coldfield.

Mr. C. W. Marshall, B.Sc., M.I.E.E., who is the chairman of the Meter and Instrument Section of the I.E.E. for 1940–41, is well known in the electricity supply industry, particularly in connection with his work in later years as technical and research engineer with the Central Electricity Board. From 1913 to 1927 he was with the Glasgow Corporation Electricity Department, where he ultimately held the position of chief technical assistant to the chief engineer. While at Glasgow he played an important part in the design and erection of the Dalmarnock power station, which was one of the first super stations in this country. He left Glasgow to take up his present position with the C.E.B. Mr. Marshall has acted as liaison officer for the Board in connection with the I.E.C., the B.S.I., and other bodies, and has also represented the Board on the Transmission and Meter and Instrument Sections of the I.E.E.

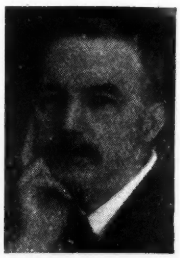
Mr. C. W. Marshall

According to *Electrical News & Engineering*, it is reported from Ottawa that **Mr. H. J. Symington** has been appointed electrical power controller, a new post created for the stated purpose of regulating the distribution of power throughout Canada. His principal duty will be to see that munition plants have an adequate power supply. Mr. Symington is Montreal electrical utilities counsel and is also a director of the Canadian National Railways.

Sir W. H. Clark has been appointed a director of the Southern Railway in place of **Mr. L. S. Amery,** who has retired.

Obituary

Mr. Peter Valentine McMahon, M.I.E.E., whose death we briefly announced in our last issue, was born in Dundalk, Co. Louth, in 1868 and received his early education at the Marist College in that town. He served his apprenticeship at Manisty's Ironworks in Dundalk, and in 1887 took up a course in electrical engineering at the Finsbury Technical College under Professors Thompson and Perry. He assisted in the Italian Exhibition installation and in 1889 was appointed by Lane, Wharton & Down as resident engineer of the Waterford central station. He joined Mather & Platt in 1890 and was engaged in the electrical equipment of the City and South London Railway, and upon the opening of the line was appointed assistant engineer to the company. In 1893-94 he made a series of experiments with electromagnetic devices, including the behaviour of different sized and shaped cores in a solenoid.



The late Mr. P. V. McMahon

Upon the retirement of Mr. B. Mott, in 1896, he was appointed engineer to the City and South London Railway Co. Mr. McMahon acted as consulting engineer for the railway company in connection with the electrical equipment and rolling stock for the extension to Clapham Common and Islington and was responsible for the introduction of the three-wire DC system of distribution with battery substation at 2,000 V. On the amalgamation of the City and South London Railway with the London Electric Railways Group, in 1915, he became superintendent of power to the London Electric Railways at Lots Road power station, where he remained until 1926. He was then appointed assistant to the chief electrical engineer and subsequently became consultant to the Railways Group until his retirement in 1933. He contributed a number of articles to the technical press and presented two papers to the I.E.E., gaining the Institution Premium in 1898 and the Willans Premium in 1904.

Sir Harold Carpenter, F.R.S., D.Sc., whose death occurred on September 13th, was Professor of Metallurgy at the Imperial College of Science and Technology, London.

Mr. C. S. Louch.—The death occurred on September 17th, at the age of sixty-three, of Mr. Charles Steane Louch, late Comptroller and Accountant of the London Passenger Transport Board.

Dr. L. G. H. Sarsfield.—We regret to learn of the sudden death on September 17th of Mr. Leslie Gerald Hunt Sarsfield, D.Sc. (Eng.), M.I.E.E., A.Inst.P., Research Engineer in the Research Department at Woolwich. Mr. Sarsfield, who was forty-four, was born in Bristol and received his education at the Merchant Venturers' College and the University in that City. In 1918 he joined the British Thomson-Houston Co., at Rugby, as transformer designer, and in 1920 was appointed assistant to the technical manager of the Morgan Crucible Co., at Battersea. He went to Woolwich in 1921. Mr. Sarsfield, who had contributed to the *Journal* of the I.E.E., was awarded the Ayrton Premium in 1929. He was the author of "Electrical Engineering in Radiology" and had contributed articles on this subject to the ELECTRICAL REVIEW.

The late Dr. Sarsfield

Mr. James Goldie, of Scotstoun, Glasgow, whose death occurred on September 8th, was a director of William M'Geoch & Co., Ltd., electrical engineers, of Glasgow.

Will—Mr. Robert Meikle, electrical engineer, of Glasgow, has left estate valued at £1,320 net.

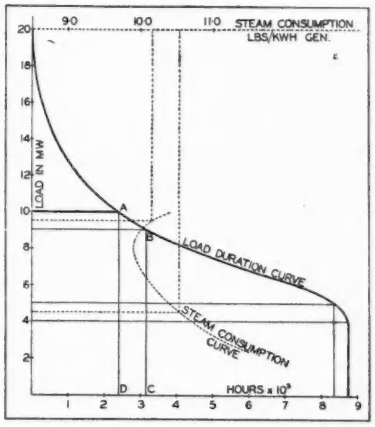
INTEGRATING STEAM CONSUMPTION

Choice of the Most Economical Size of Turbine

By R. C. Golding, M.Sc.(Eng.), A.M.I.E.E.

THE practice adopted by generating stations, with respect to the choice of new turbines to offset growth of load varies widely. In recent years examples have been seen of new turbines installed which have a capacity of less than half of the total demand to be met, while in other cases the load is not sufficient to load the machine fully for some years after commissioning. Even in these days those responsible for choosing the size of a turbine extension are often heard quoting the reduced steam consumption of a bigger machine against the increased capital charges, in the belief that a decision in this direction will bring a reduction in operating costs. This is often far from being the case, except in those instances where the load is so comparatively great that the machine need seldom be run at a load less than the economic rating.

Where machine sizes and loads are comparable, such quantities as maximum demand, load factor, and the slope of the steam consumption curve form a number of interdependent variants, which tend to confuse the issue. It should first be realised that the average load carried by the machine gives little or no indication of resulting economy. Any attempt to apply the average load to the steam consumption curve in an endeavour to assess the average steam consumption presupposes the steam curve to be a straight line. An obvious example of this can be seen from the instance of a machine running one half its time at 60 per cent. load factor, and the other half at 100 per cent. The method of averages would show that it would run all its time at economic rating, which is far from the truth.



The accompanying graphs and procedure, although not too complicated, possess the advantage of reasonable accuracy and are well within the capabilities of anyone with an elementary knowledge of power station statistics. As shown in the diagram the load duration curve is first plotted, and superimposed on this is the consumption curve of the suggested turbine, plotted to the same ordinate of megawatts generated. Various modifications tending to further simplification will appear as the work proceeds. For example, if the comparative merit of a number of sets is desired, each steam consumption curve can be applied in turn on tracing paper.

TABLE I.

(1) Load group, MW	(2) Average load, MW	(3) Cumulative hours	(4) Group hours	(5) kWh generated $\times 10^6$ (2) × (4)	(6) Steam consumption at load in Col. (2)	(7) Total steam consumed lb. $\times 10^6$ (5) × (6)
4	4	8760	0	—	10.725	—
4–5	4.5	8400	360	1.62	10.525	17.05
5–6	5.5	7250	1150	6.33	10.25	64.88
6–7	6.5	5700	1550	10.07	10.05	101.20
7–8	7.5	4250	1450	10.88	9.925	107.98
8–9	8.5	3150	1100	9.35	9.925	92.80
9–10	9.5	2400	750	7.13	10.175	72.55
10	10	0	2400	24.00	10.4	249.60
				69.38		706.06

From inspection of the two superimposed graphs Table I will now emerge. Column (1) gives each MW step, up to the maximum size of the turbine. As will be seen, no loads are generated below 4.0 MW. Column (3) gives the cumulative hours, reversed, during which these loads occur, and by subtraction, the hours are obtained during which the load lies in any specific group. These figures are obtained directly from the ordinate—load duration curve—abscissa. By multiplication of the number of hours by the average load we obtain in column (5), the number of kWh generated in any group, which is represented on the diagram by the area of such four-sided figures as A, B, C, D. This assumes, of course, that both curves are formed of sections of straight lines, which is true when the sections are reduced in length *ad infinitum*. Thus the smaller the groups in column (1), the more accurate will be the result. There is no need, however, to take steps of less than 10 per cent. of the size of the turbine.

To obtain the steam consumption in column (6), the average load in each group is read off on the steam consumption curve, such as 9 to 10 MW at 9.5 MW gives a steam consumption of 10.175 lb. per kWh generated. This, multiplied by the kWh generated in the group, column (6), will give in column (7) the total steam consumption for the set over all the varying loads to be met, in this case 706 million lb. of steam per annum. This is equivalent to 10.17 lb. per kWh generated. It will be found that 69.38 million kWh generated represents an average load of 7,920 kW, giving from the graph an average steam consumption of 9.9 lb. per kWh generated, involving an error of 2.7 per cent. if the average load is used directly.

In effect this average steam consumption of 10.17 lb. has resulted in a measure of the increased heat consumption in the station due to the limitations of load available from hour to hour. This can be expressed as an "operation factor," being that amount by which the station efficiency will be reduced below the optimum represented by continuous running at economic rating, in this case $\frac{9.9}{10.17}=0.973$

Table II can now be drawn up giving the total losses, and thus the performance of the new plant under consideration.

TABLE II.

Steam pressure 300 lb. per sq. in. (gauge).	Temperature 800° F.
Total heat at stop valve per lb. steam	1423.0 BThU.
Average vacuum	28.9 in. Hg.
Vacuum temperature	81.8 deg. F.
Heat expended per lb. steam	1373.2
Heat drop	495.31 BThU.
Estimated gain by feed heating	1.04 per cent.
Maximum cycle efficiency	37.50 per cent.
Turbine efficiency ratio	.80
Alternator efficiency	.98
Thermo-dynamic efficiency at economic rating	29.40 per cent.
Operation factor	.973
Actual thermo-dynamic efficiency	28.60 per cent.
Boiler-house efficiency	.83
Radiation, etc.	.99
Efficiency per kWh generated	23.50 per cent.
Auxiliaries at average load	.95
Efficiency per kWh sent out	22.30 per cent.

This calculation while giving a strictly theoretical result can be checked at certain points. The first five lines are dealt with by steam tables. The estimated gain by feed heating can be adjudged as a factor varying from 101 in the case of a hot well in which the only form of feed heating is by means of gland steam or steam pump exhaust, to 108 in the case of a modern high-pressure plant with four stages of bleeding. The thermo-dynamic efficiency of the turbine should be quoted on any tenders which are available, though if this figure is used it should be checked to ensure that it allows for feed heating, gland losses, ejectair consumption, etc., which are sometimes omitted.

While the above result will now enable any combination of pressure, temperature, size of set, feed temperature, etc., to be placed on a comparative basis it must be accepted

with reservation if it is expected to obtain actual results approaching this figure. The ultimate figure arrived at is an optimum, but before assuming that this result will be attained in practice certain other factors should be studied. These are banking of boilers, which have not been included since the introduction of new boilers may necessitate a new factor in the calculation, where past experience in the station might be inapplicable. Account must also be taken of overhaul periods, when the generation may be reduced or the efficiency impaired, and in particular of a further factor dealing with the effect of the human element.

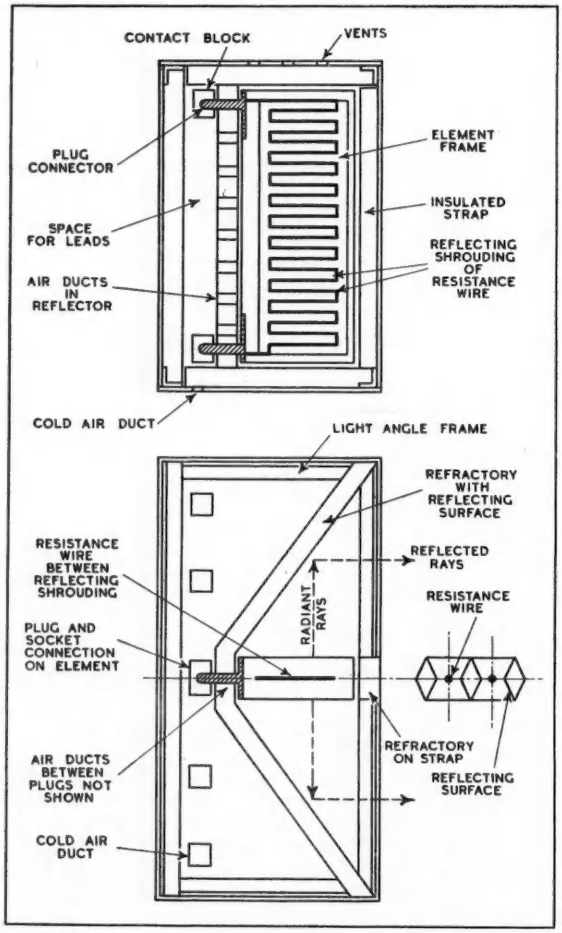
It has been assumed that the set is loaded as fully as possible at every instant that load is available, but at certain periods other sets must be run up for peaking, and standby purposes, while, on some occasions, sets will be paralleled in anticipation of a peak which may not materialise. All these tend to depress the overall efficiency and will introduce a factor which ranges down to 0.8. If it is desired to assess this, the above computation can be completed for the sets running over a past period, when actual results are to hand, and comparison with the ideal will afford the adjusting factor for the station.

Convection Reflector Heater

By J. L. Gaved

THE design of electric fire illustrated is based upon a simple idea, *viz.*, the direction of the heat rays emanating from a single strand of resistance wire in such a manner as to eliminate interaction and turbulence. A direct unimpeded path for the rays of each leg of the element is adopted. Duplex reflective barriers separate the individual straight lengths and also the turns of the wire. Radiation takes place in a straight line on both sides of the element. The heat rays are then reflected by the polished surfaces in parallel lines of uniform intensity.

The element is formed in a refractory material with plug-type terminals which correspond with sockets fitted at the apex of the reflector. As an additional support for the element as well as to provide protection from abrasion,



Top : Section through centre line. Bottom : Sectional plan through top contact, with enlarged scale section showing arrangement of reflecting shrouding between turns of resistance wire

a cross bar of refractory material embedded in a metal casing is attached to the frame of the fire. This disposition of the element relative to the reflector secures total reflection of the heat rays and no direct radiation from the element takes place towards the front.

At the apex of the conical reflector and between the terminal sockets perforations provide an entry for cool air drawn from below the frame into a recessed space directly behind the reflector. The two-fold duty of this feature is the prevention of stagnated zones of intense heat within the reflector and the constant convection of heat by circulating air to produce a generous diffusion within the room.

For capacities greater than 1 kW the essential feature of one reflector to each element has to be maintained so that either a larger size element and frame or a number of complete assemblies of the 1-kW rating are necessary to meet the requirements.

Electro-metallurgy Cheapens Production

HOW the production of aluminium, magnesium, sodium, calcium, ferro-chromium, silicon, etc., had been cheapened by electro-metallurgy was emphasised at a meeting earlier this year of the American Electro-Chemical Society. Metallic ores are now also being successfully melted, there being 1,000 electric furnaces in use in the United States. One lecturer pointed out that pig-iron might be produced with cheap electric heat in competition with melting furnaces using expensive coke. Assuming the present dollar equivalent to be 5s., coke to cost 75s. per ton and electricity at 1s. 6d. per kWh, blast-furnace smelting would cost 71.25s. per ton of pig-iron and need 1,900 lb. of coke. Electrical reduction would cost 60.85s. and require 800 lb. of coke (for chemical purposes only) together with 1,850 kWh.

In steel making by electric furnaces there was a tendency to increase the capacity of high-frequency induction furnaces from 1,000 lb. to between 4 and 8 tons ; this last-mentioned size was the largest in operation, but 15-ton furnaces had been built. There was also a tendency to reduce the size of arc furnaces from 100 to about 40 tons. According to the *Iron and Coal Trades Review* both arc and high-frequency furnaces were used in producing stainless steel. Arc furnaces probably were about 5s. a ton cheaper in cost of energy expended, but introduced difficulties in oxidation of chromium which must be reduced again from the slag by means of silicon or aluminium ; and by dangers in absorption of hydrogen by the metal, especially if the chromium content was not large, or if silicon was present.

The induction furnace usually oxidised costly alloying elements to a lesser extent. These including chromium, titanium, etc. This type of furnace also had a great advantage in controlled circulation of the bath. For reclaiming stainless scrap, one large American company used a duplex process consisting of an arc-furnace in combination with an induction furnace of low frequency with magnetic core. This avoided hydrogen absorption and enabled stainless steel of low carbon content to be made easily.

FARM SUPPLIES

Reducing Distribution Costs to the Minimum

By A. Stewart

A RECENT issue of the *Journal* of the Ministry of Agriculture and Fisheries contains a Departmental report on the progress of electricity supply in rural areas. This report makes a definite claim that electricity, even at present rural rates, is a sound proposition for the farmer. The report goes on to deplore the difficulties of getting supplies to farms owing to the cost of service lines, and suggests that unification of control of the distribution side of the electrical industry may be the solution. The report also mentions a figure of 150,000 farms without electricity, but gives no details about class or type.

Undoubtedly the grid system has made it easier for rural authorities to obtain supplies of electricity and, in addition, by relieving distributing authorities of the responsibility of generation, it has made it easier for them to concentrate on sales promotion. Capital which would have been invested in plant and machinery is now available for development work.

Despite concentrated efforts on sales very few farms are making the maximum use of electricity. It cannot be denied that, except in certain special areas, only the fringe of rural electrification has been touched. The true picture of development is seen in those areas where the hard rule of economics has been applied to all development schemes. In these areas the scattered rural property is expensive to supply and, as the Departmental report points out, in the case of farms would-be consumers are frequently called upon to pay service line charges in order to make the schemes economic.

Service Line Charges

Contributions or service line charges, whether large or small, have a very adverse effect on the would-be consumer. Despite all the bland arguments of the supply salesman the prospective consumer feels that he is being asked to pay money for nothing. In commercial or agricultural marketing it is almost impossible to find an analogy for the distribution and sale of electricity. The average farmer cannot readily grasp the inherent principle of fairness in electricity supply contracts. At heart the farmer is a dealer and believes that even standard terms may be varied to close a hard bargain.

A farmer's reasoning as often as not is typically that he can buy a gallon of paraffin at a local shop and expect to pay 8d. If he buys a storage tank the oil company will deliver the oil at about 6d. a gallon. Also when he buys feeding stuffs he knows that he must pay carriage on half a ton, but if he buys a load he gets a cheaper rate, and free delivery thrown in. Now when he wants electricity he is told that he must defray part of the cost of the line which is earning revenue for the supply authority. This sounds to him like the oil company asking him to pay for the lorry which brings him oil.

The salesman for the electricity authority may marshal all the arguments about improvements to the property, about the money only being an investment, about the economic factors, but they are useless against the farmer's plain statement that " You've got the goods to sell ; well bring them into the market, we are here ready to buy."

What is the electrical industry doing to get the goods into the market ? Supply authorities cannot afford to sit on the fence and adopt a " take it or leave it " attitude. If the selling system does not work, the first thing to do is to examine the selling system, not blame the customer.

As the greatest difficulty always arises over the charges for service lines, excess capital spent on providing a supply is a two-fold heavy burden. In the first place, it restricts the number of would-be consumers owing to high service line charges, and, secondly, it is a burden to existing consumers in that the high depreciation charges prevent those progressive reductions in tariff charges which might be expected in an expanding business.

In the rural field electricity is not without competition, and there is little very new that electricity can offer to the farmer. It can offer vast improvements on existing services, but that is all. So when asking a farmer to spend money on providing a supply remember that his capital is to be expended on improvements only.

Three-phase ?

Bearing these facts in mind, it becomes obvious why it is necessary to cut down distribution costs to the minimum and so reduce service line charges. General reasoning suggests a three-phase system, but its justification is not so easy.

The average mixed or arable farm will require a 2-HP motor for water pumping, 1-HP for milking, and possibly 2-HP for a sack hoist ; also 15-HP for barn machinery and possibly 7½-HP for a saw bench. The small machines can all be of the capacitor type, single-phase, started direct across the line. As the larger sizes are fitted to machines which will probably have fast and loose pulleys, no special starting torque is necessary. Therefore split-phase starting with a graduated resistance will be quite suitable. The objection to single-phase motors on account of their cost is not very formidable to-day. Comparative prices of a 15-HP motor running at 950 RPM differ by only £14. The installation costs are practically the same for single- or three-phase. As a farmer will spend probably £100 to equip his farm with wiring and motors, he will be ready to spend that little extra on a tangible asset. It will certainly be easier to obtain this than a much larger sum for a contribution which the farmer does not regard as an asset.

Distribution engineers are fully aware of the advantages of three-phase systems. The line currents are only a fraction of those in single-phase systems, but farms are naturally very scattered which means that a farm is frequently only 50 yds. or so from a transformer. The line currents for the greater part of the distribution will be on the high-voltage system.

Strength of Conductors

Now the choice of conductor for spur lines is more a question of mechanical strength than current-carrying capacity. Even with a 25-kVA transformer, the current on a single-phase 6.6 kV system hardly reaches 5 A. Therefore the line losses due to the heating effect of the current can be neglected, as the conductor will be of at least 0.02 sq. in. and more likely 0.035 sq. in. section. Further, the farm power load on which the necessity for three-phase is based has a very low load factor. Very few machines exceed 700 hours per annum, except possibly on a large stock farm for daily grinding.

The line losses due to the motor load will generally be of short duration. In addition to the motor load the farmer may install an 8-kW steriliser for use in the dairy. Many supply authorities allow such apparatus to be connected through a change-over switch in the motor circuit. By this means they can offer supply to a steriliser without a " fixed charge " and thereby avoid a short duration peak on the local distribution. In addition, there may probably be installed a 2-kW water heater, 2 or 3 kW of heating in poultry appliances, combined with not more than 1 kW of lighting.

The farm residence, which may be supplied from the same transformer, will have a connected load of about 15 kW if cooking and water heating are done by electricity. The maximum demand of a farm load such as this may be well within the capacity of a 25-kVA single-phase transformer.

Transformer Loading Comparisons

In this connection careful study of actual load conditions may prove that a single-phase transformer has larger useful capacity than a similarly rated three-phase transformer. A residence with a cooker, fires and water heating

may easily establish a maximum demand of 7 kVA. If given (as normally recommended) a single-phase supply from a three-phase, 25-kVA transformer, it will practically load up this one phase, since the transformer may be considered as equivalent to three 8⅓-kVA units.

Now, if a 15-HP motor requiring, say, 12 kVA is also running, the transformer loading will be in first phase 4 kVA; second phase 4 kVA; and third phase 11 kVA. Thus the transformer will be 30 per cent. overloaded on one phase so that no more three-phase power can be used. Despite these conditions the total load on the transformer will only amount to 19 kVA. With single-phase transformers this difficulty would not arise.

Ease of Erection

Where farm supplies are bound up with a supply to a village there is no apparent reason for a three-phase system. The few motors met with on pumps and in small village workshops can nearly always be of the types already mentioned. The use of single-phase low-voltage distribution in villages is also much cheaper and much easier to erect, for although only one-third of the weight of copper is required to transmit a given amount of power by a three-phase, four-wire system as compared with single-phase (with the same percentage losses), physical construction is normally of major importance in the lightly loaded distribution network of a village.

Rural overhead low-voltage systems are difficult to erect in a neat manner, and the use of three-phase does not only mean four conductors instead of two, but a considerable increase in pole heights and diameters, extra stays, and more Post Office line modifications. All these items add considerably to the cost of a scheme.

When a number of farms and groups of houses are scattered over a wide area consideration should be given to the recently introduced combined high- and low-voltage single-phase system. A single-phase supply at 6.6 kV is taken from a step-down transformer on the main 33-kV or 11-kV line, and at convenient points 6600/230 V transformers are fitted. The low-voltage conductors are run on the same poles wherever possible. Systems similar to this have been in use in America for some years, and its introduction to this country is most welcome. It is essential that this system be used only where there is to be a number of 230-V transformers. Where only one or two are used the saving in line costs will not offset the cost of the main 6.6-kV step-down transformer.

Frequent Transformers

The ideal arrangement of a transformer within 400 yd. of each consumer was a year or two ago almost beyond the dreams of rural distribution engineers. The system has now passed beyond the experimental stage and no doubt the greater use made of it will result in further economy by reason of reduced prices of the transformers and switches.

The author believes that in rural areas single-phase will give a service which compares favourably with that of a three-phase system, and it is definitely much cheaper. If by its adoption service line charges and the capital spent per consumer can be reduced the industry and the consumer must benefit.

If rural supply authorities will give a clear lead to manufacturers of electrical equipment and adopt a common policy, it is reasonable to believe that the costs of single-phase transformers and switchgear, motors and appliances, could be greatly reduced.

Generator Cooling

Heat-recovery System

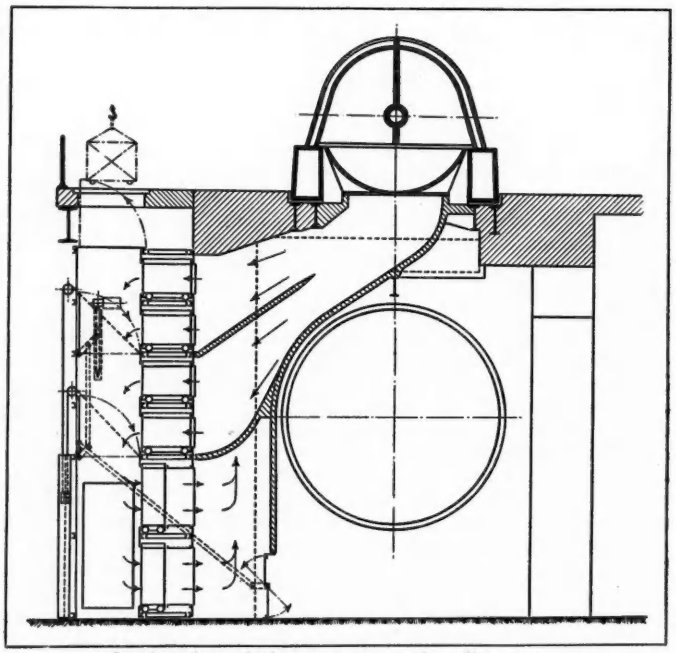
A STEAM turbo-generator with a rather unusual cooling system, which permits recovery of the heat evolved in the generator, has been installed in the Liège municipal electricity station, Belgium. The turbine was built by the Ateliers de Construction de la Meuse, and is directly coupled to an A.C.E.C. generator.

The turbine has a high-pressure section with eight wheels and a low-pressure section with ten wheels. Four valves admit steam, but only two are normally used. The remaining two serve for overloading the machine in case of need. With normal steam and condenser water temperatures it is possible by means of these valves to run up the turbine to generate 27,500 kW, which corresponds to the maximum output of the generator at unity power factor. The condenser is of the Delas type and of all-welded construction, mounted without sliding tubes or flexible joints between it and the turbine.

Instead of being placed under the generator as is normally the case the cooling system is composed of superposed coils fixed on to the side of the concrete foundation. The four main cooling coils are, moreover, in the circuit of the condensate of the turbine condensers, so that this condensate absorbs the heat from the generator. Two additional cooling coils can be fed with raw water.

A six-celled frame, entirely closed to the air from outside, holds the cooling coils. The ducts to and from the generator are so arranged that the hot air flows down through a duct which leads it over the four main cooling elements, through which it passes out into the air-tight box frame of the coil supports. Here it flows down, back over the two auxiliary cooling coils and up again towards the generator.

Normally, the auxiliary cooling coils are not fed with water, the main coils being sufficient to provide sufficient cooling. Under test, it was found that the auxiliary coils were unnecessary, even when the generator was running overloaded. They offer an extra margin of security. however, and may prove of use in hot summer weather, Normally, the recovery of heat is 100 per cent., but even if the auxiliary coils are fed with raw cooling water, the recovery still amounts to 75 per cent. The arrangement of the system is shown in the accompanying illustration.



Section through the generator and cooling system

COMMERCIAL and INDUSTRIAL NEWS

Encouraging Export Trade. Reserved Occupations. Mobile Kitchen

Restaurant Lighting

KIMBELL'S RESTAURANT, Chichester, which was recently opened, is of novel design and is exceptionally attractive and cosy. Seating 200 diners, the combined restaurant and ballroom has the bandstand sited between the curved stairway leading to the balcony and cloakrooms, and 150 couples can be comfortably accommodated for dancing. Leading through the shop is a foyer with a rock garden and waterfall which is illuminated from the back, making it cool and refreshing upon entering the dining-room. Above the shop is a private dining-room seating 80 persons, which will be used for wedding receptions, private dinners, &c.

Indirect pendant fittings supplemented by wall brackets provide soft, well-diffused lighting for this room, and in the shop similar indirect fittings give an ample flood of glareless, shadowless lighting. The lighting scheme in the main restaurant is designed to give colour-change effects from the laylight, which covers 800 sq. ft., and from the cornice along the outer edge of the soffit of the balcony. This effect is not, however, being utilised during the war, illumination being provided by ordinary lamps in indirect wall brackets. Special lighting has also been provided for the telephone kiosks, &c. G.V.D. Illuminators, Ltd., were the advisers and also the suppliers of the lighting fittings. The electrical contractor was Mr. T. F. Lummus, of Chichester.

Good lighting in a Chichester restaurant

Productive Capacity

The thirteen Area Boards established by the Industrial Capacity Council have completed a most comprehensive index covering the bulk of the factory and machine-tool capacity of Great Britain and Northern Ireland. This will enable the Council to allocate work to those factories best able to cope with it and to indicate to large contractors which firms can take on subcontracts for war production.

Export Trade Drive

In the course of an interview with a *Sunday Times* representative last week, Mr. Harcourt Johnstone, Parliamentary Secretary to the Department of Overseas Trade, gave some particulars of measures which were being taken to improve our export trade. He referred to the setbacks to that trade caused by events during the past few months. The German occupation of Norway, Denmark, Holland, Belgium and France and the entry of Italy into the war had meant a loss of neutral markets and had rendered others difficult of access. In addition the need to replace equipment lost by the British Expeditionary Force on the Continent had diverted industrial resources from export work to help in the great armaments drive. Last month's export figures would, he believed, show an improvement over those for July, although they would still be below the April level.

German propaganda had been very active in Central and South America, but it was now losing some of its effectiveness since the would-be purchaser of German goods realised that he would not get them while Great Britain held command of the seas. Suggestions that we were unable to fulfil orders could be countered by keeping on delivering the goods. It was unfortunate that the principal demand was for capital goods which used up large quantities of steel. We had to foster a demand for goods which did not involve the use of great quantities of raw materials but fetched good prices because of the high standard of workmanship and design.

Among the measures which were being taken to develop markets in the most desirable way were projected exhibitions and missions to South America, regarding which details might be expected shortly. The United Kingdom Commercial Corporation, which was set up to promote trade with the Balkans, had extended its activities to Turkey, Spain and Portugal, and was now developing its activities in Argentina.

Its function was not to replace existing trade channels but to aid them. Higher standards of market knowledge, arrangements for service and credit facilities and for holding stocks were obvious means by which the Corporation could assist traders.

Germany had benefited by her attention to consignment goods which enabled the foreign merchant to draw upon stocks as and when he required them, thus avoiding delays in delivery. Under the new scheme the Argentine purchaser would be able to go to the Corporation and tell it what stocks he required over a long period. The Corporation would finance the whole supply and the customer would be able to draw upon it according to his needs. Although there were many incalculable factors which forbade facile optimism there were certain solid advantages which made it possible to look forward to a gradual improvement in the position.

The Political Correspondent of the *Sunday Times* says the Marquess of Willingdon will head the mission to which Mr. Harcourt Johnstone referred. The mission will include a number of prominent industrialists and after visiting Argentina will go on to Brazil and Chile.

Scientific Workers' Conference

Questions affecting industrial scientists, engineers and technicians were discussed at a conference held in Glasgow on September 21st under the auspices of the Association of Scientific Workers. Similar conferences have been held in London, Birmingham, Manchester and Liverpool. Prof. F. J. Wilson presided and Prof. H. Levy opened the proceedings with a general survey of the problems of scientists employed in industry. Salaries, working hours and various other employment problems were considered by the conference. The speakers included Mr. H. S. Corran, Dr. G. D. Muir, Mr. C. A. Oakley and Mr. J. F. Wallace, Scottish secretary, Electrical Power Engineers' Association.

Changes in Reserved Occupations

A number of changes in the Schedule of Reserved Occupations are announced by the Minister of Labour. Most are intended to facilitate volunteering for one or other of the national defence services. One alteration is retrospective in effect; from July 29th the age of reservation of wireless engineers, wireless (radio) repairers, wireless mechanics and service men is raised from 30 to 35. The list of additional occupations in which men may, irrespective of age, volunteer for service in any branch of the national defence services is a long one. Men in the occupations of wireless engineer, fault finder, tester, wireless (radio) repairer, wireless mechanic and service men, who are above the age of reservation, may be accepted as volunteers for service in the armed forces in their trade capacity. Men in the Schedule under the heading "Scientific Worker, Research Worker" who volunteer may, irrespective of age, be accepted for general service in the forces subject to the consent of the Scientific Research Committee of the Central Register Advisory Council.

Mobile Demonstration Kitchen

A trailer cookery demonstration kitchen by Mrs. William Paterson, honorary organiser, welfare canteens, Electrical Association for Women, was presented by her on September 16th to the London County Council at County Hall. It is primarily intended for educational purposes in connection with the Food Education Campaign, but will immediately be used for communal feeding in the recently distressed areas of London.

This mobile kitchen demonstrates to the ordinary housewife how a small kitchen may be thoughtfully planned as a compact labour-saving little workshop in which everything has its place, and will perhaps stimulate the woman in the home to think of replanning her own kitchen in a simple way, bearing in mind the practical devices used in this model kitchen. Full use is made of wall space to accommodate cupboards for china and cooking utensils. A special cool cavity is designed to keep milk and butter well away from the cooking centre, wire racks behind a glass door hold vegetables, "stretchable" wires through saucepan handles keep them in place, and "hat blocks" prevent cups and jugs from slipping. The front of the water tank above the sink is used as a blackboard for demonstration purposes, and this idea may appeal to the woman who wants to "jot something down." An oil cooker is installed and the demonstration kitchen is also wired for electricity to enable this modern method of cooking to be used when it is available.

Work after the Sirens

Speaking at a luncheon of the Works Managers' Association in London on September 18th, the Minister of Labour emphasised the need for continuing production of munitions as long as possible during air raids. He said that industry had shown that it was capable of making a ready response to a lead, and he was grateful to workers and managements alike for the prompt way they had adopted the ideas thrown out to minimise the effect of air raids. He hoped industry would use its initiative and ingenuity to overcome any hindrance to output by these air attacks. Those who took great risks to keep pro-

duction going under hazardous conditions were entitled to be treated generously by the State.

Mr. Bevin's advice to managers, trade unionists, shop stewards and everybody was not to wait for Government regulations. Combined effort should be made to make good any loss and that could not be done by rigid rules. The Joint Consultative Committee had worked out a novel scheme of hours and labour. It was impossible to keep on working seven days a week, and production was beginning to decline. He thought the amount of overtime now permitted meant a great physical strain. More attention should be paid to the question of hours of work and rest. Before long they would be passing out 250,000 to 300,000 trainees a year for munitions production from the Government training centres. By means of training and transfer they had eaten into the hard core of unemployment.

Henley's Address

We regret that in reviewing the company's book "Practical Cable Jointing" in our issue of September 13th, we gave the address of W. T. Henley's Telegraph Works Co., Ltd., incorrectly. It should have been Milton Court, Westcott, Dorking.

Domestic Apparatus for Export

Electroway Heaters, Ltd., Sparrow Hill, Loughborough, inform us that they have brought out several products especially for export purposes. One is an inset fire to meet Dutch competition in South Africa, where they have a well-established method of mounting direct over a wall cavity, a practice not recommended in this country, but insisted on out there. Other lines designed exclusively for export are cheap portable fires and boiling rings.

Copper Development Association

The Copper Development Association has now removed its offices, formerly in Thames House, to Grand Buildings, Trafalgar Square, London, W.C.2 (Telephone: Abbey 2677). The services and publications of the Association are still available to all, free of charge. At the present time, many firms and individuals are being called upon to undertake work involving the use of copper and its alloys, of which they have not had very much previous experience, and it is in such cases that the Association can be of particular assistance. As is well known, the Copper Development Association is an entirely non-commercial organisation maintained by the British copper industry; its services and staff are unreservedly at the disposal of all concerned with copper and copper alloys, and in the national interest it is recommended that when any information about such materials is required, reference should at once be made to the Association.

Turkish Import Trade

During the first half of the current year Turkey imported electric motors to the value of £T501,000, a very severe decline as compared with the corresponding period of last year, when the value was £T1,200,000. There was also a substantial decline in machinery exports—from £T7,657,000 to £T4,437,000.

Fatalities

An inquest was held at Norwich on September 16th on Sapper Gordon Whitehouse, R.E., who was killed while loading an excavator on to a trailer. It was stated in evidence that the excavator was near an 11,000-V overhead line and that the jib must have touched the line. Normally the top of the jib would have been about 15 ft. from the ground, but it had to be raised to enable the trailer to be coupled to a lorry.

The Worcester Coroner returned a verdict of "Death by misadventure" at an inquest into the death of an eight-year old boy. Apparently the boy, with another child, climbed a transmission line tower belonging to the Worcester Corporation and came into contact with one of the lines which was operating at 6,600 V. It was stated that there was a climbing guard 10 ft. from the ground; a "Danger" notice which had originally been fixed to the tower had been removed by some unauthorised person. The Coroner expressed the opinion that towers in fields which were accessible to the public should be made more difficult to climb. An effective guard would be much better than a notice.

That the Mersey Power Company might make provision for two precautionary measures—insulating the wires or placing them underground—to avoid a repetition of similar accidents, was the suggestion made by the Coroner at an inquest on Enoch Price, farmer, of Church Farm, Stoak, who was killed when the top of an elevator he was moving came into contact with an overhead line. Mr. David Hughes (Chester), who appeared for the relatives, put it to a representative of the Mersey Power Company that it was dangerous for live wires to be placed over a stackyard where farm implements were usually kept. Mr. J. H. Roberts, district electrical assistant to the Mersey Power Co., replying to the Coroner, said it was the practice to put the wires as low as 23 ft. The regulations stated a minimum of 15 ft. for under 3,000 V.; this was a 1,750-V line. When such wires were being placed, the occupier was informed of possible danger from them. A verdict of "Death by misadventure" was returned.

Electric Fires in Shelters

The borough electrical engineer of Rotherham (Mr. W. H. Duffett) announces that there is no intention of interrupting the town's electricity supply during air-raids and says that there is no need for consumers to pull out their main switches. At the same time he issues a warning with regard to the use of electric fires in air-raid shelters, particularly those of the Anderson type. He points to the danger of running temporary wires from a two-pin plug or lampholder; there is a great risk of fatal shock in the conditions which prevail in most shelters. The only way to ensure a satisfactory installation is to employ a qualified electrician and people desiring such installations should get into touch with their wiring contractors. There is little hope, Mr. Duffett says, of the Corporation Electricity Department being able to undertake the work.

A similar warning regarding the dangers of improperly-installed fires in shelters has been issued by the Portsmouth Electricity Department, which has offered to inspect and pass installations free of charge upon application to the Department.

National Scrap Metal Survey

A survey of the national reserves of scrap metal, particularly iron and steel, is to be made by the Minister of Supply. Derelict buildings, condemned bridges, abandoned mines and quarries will be inspected, as well as abandoned railway lines in mines and quarries. The survey will also include those steel frameworks which never received their coverings of stone or brick before the ban on new building came into force.

Fire Watchers in Buildings

The Minister of Home Security has made an Order under the Defence Regulations providing that a fire watcher shall be present at all times in all premises in which more than thirty persons work. This Order applies in addition to any premises, whether or not more than thirty persons work therein, the whole or any part of which is used as a warehouse of greater capacity than 50,000 cu. ft., and any sawmill or timber yard containing more than 50,000 cu. ft. of timber. The Order does not apply to a warehouse when it is empty, or to premises which form part of any mine or quarry. The person responsible under the Order for seeing that it is carried out is the occupier of the premises.

Old Torch Batteries

What may become an important new war industry has been started by the Salvage Department of the Ministry of Supply. The Ministry has experimented with some of the many thousands of used torch and high-tension batteries, collected from houses and business premises, for which hitherto there has been no useful outlet. As a result of these experiments several firms are now recovering from the batteries carbon, zinc, manganese ore, brass, copper and other materials useful in the war effort. To these firms the Ministry has given every encouragement. As soon as it was proved that salvaged batteries could be used again, a circular was posted to local authorities pointing out the importance of the materials made available. The new industry is only in its infancy. One firm which at present buys about 10 tons of batteries a week from local authorities could use 100 tons if they could be collected. One hundred tons of high-tension batteries will yield approximately 10 tons of zinc, 3 tons of carbon rods, 10 tons of pitch, 3 tons of pulverised carbon, 1 ton of brass and copper, 10 tons of cardboard, and 50 tons mixture of graphite, manganese ore and beconite. The brass can be used for making buttons for uniforms; the copper goes to make bands for shells; the zinc is used for camp utensils; and graphite is needed for machine grease and soldiers' boot blacking. Batteries put out for collection by the dustmen should, if it is requested by the local authority, be wrapped separately to keep them clean and not included with ordinary rubbish.

Goods in Wholesale Warehouses

Under a plan to reduce the risk of air raid damage to large stocks of goods held in wholesale warehouses, announced by the Board of Trade on Saturday, wholesalers whose quotas are exhausted may now, without infringement of Supply Limitation Orders, place such goods at retailers' premises for storage only. The retailer will acquire no interest in the goods, although he may have ordered similar goods from the wholesaler. If the stored goods are appropriated to an Order by the retailer they will be considered to be "supplied" at the time of the appropriation.

Control of Plastics

The Minister of Supply has issued the Control of Plastics (No. 1) Order which comes into force on October 1st. Plastics in the form of moulding powder in the production of which any of certain raw materials have been used may not be bought, sold or used except under licence. The raw materials specified are formaldehyde, phenol, cresol, urea, thio-urea and cellulose acetate. Any inquiries should be addressed to the Ministry of Supply, Plastics Control, Great Burgh, Epsom, Surrey.

Irish Electrical News

The contractor for the erection of a kitchen annexe at the Dublin municipal sanatorium, subsequent to the acceptance of his tender, informed the Committee concerned that he would only be prepared to carry on the work if an increase of 10 per cent. were allowed. The reason given was that prices had gone up since the date of his tender. As a sequel to representations made by the builders, McMullan Bros., S. Duffin, Ltd., and W. A. Bartlett, the Electricity Committee consented to include in their contracts for the erection of sub-station buildings an additional clause safeguarding the contractors against rises in the price of materials.

After an animated debate the Belfast City Council has adopted a rule, submitted by the General Purposes Committee, to the effect that any contractor withdrawing a tender, after it has been recommended for acceptance, will not be allowed to execute work for the Corporation for two years after the withdrawal. Since the war began the Corporation has suffered loss by tender withdrawals on the plea of increases in cost of materials and in wages.

Change of Address

Moffats Ltd. are temporarily closing their London offices and showrooms at 1, Newman Street, W.1, and their temporary office is at 37, Grange Park Avenue, Winchmore Hill, London, N.21 (telephone: Laburnum 2672).

Catalogues and Lists

B. J. Legg (Industries), Ltd., Williamson Street, Wolverhampton.—An illustrated leaflet describing the company's A.R.P. shelter-lighting unit.

The British Thomson-Houston Co., Ltd., Crown House, Aldwych, London, W.C.2.—An abridged price list of "Mazda" lamps.

ACTIVITY IN MALAYA

War Ends Mining Slump

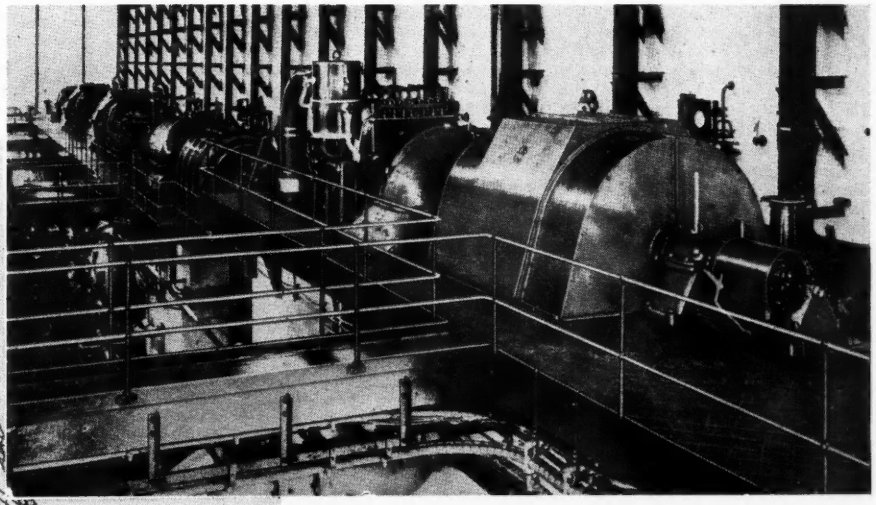
ROUGHLY 90 per cent. of the electricity generated in the Federated Malay States is taken by the mining industry. Consequently, as Mr. H. R. Sparrow, M.I.E.E., Adviser on Electricity, points out in his annual report, the abnormal character of last year, with its swiftly moving procession of international crises, has been reflected to a considerable extent in the activities of the Government Electrical Department.

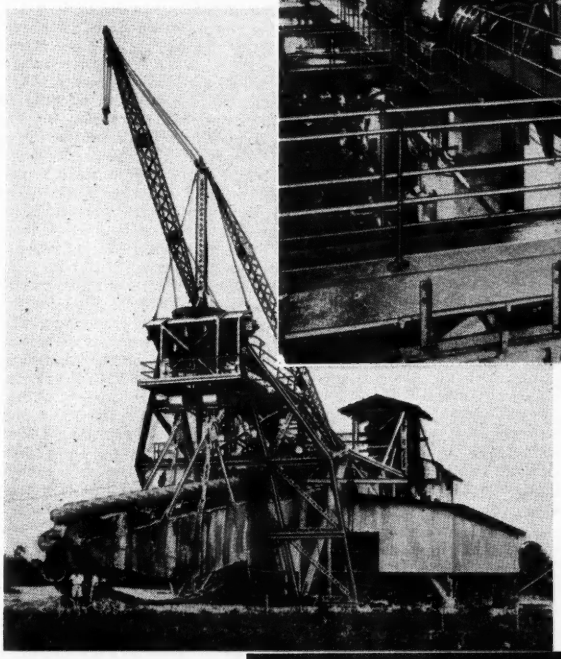
The output of the Selangor system in particular responds very quickly to a rise or fall in the production of tin, and while in April the daily output was 125,000 kWh, with a maximum load of 8,000 kW, by December it had risen to 249,000 kWh, with an m.d. of 15,000 kW. A large part of this increase in load was connected up in the three months following the outbreak of war, when it was most difficult to obtain delivery of electrical apparatus from England, and the abilities of the staff were taxed to the utmost in coping with the rush of work and in devising means of utilising available materials to the best advantage.

As a result of the semi-slump conditions obtaining in the tin mining and rubber industries during eight months of the year the total amount of electricity generated in the F.M.S. by power stations of 100 kW and over was only 327.7 million kWh in 1939 as compared with 375.4 million kWh in 1938 and 521.0 million kWh in 1937. Of last year's total 186.8 million kWh was generated by hydro-electric means, 104.9 million kWh by steam plant and 36.0 million kWh by oil-engine sets. Altogether 265.1 million kWh was supplied to the tin mining industry, 9.3 million kWh for coal mining and 6.3 million kWh for gold mining, with 46.9 million kWh for other industrial uses and lighting and domestic applications.

Government power stations produced 69.3 million kWh last year against 71.5 million kWh in 1938. Extensions to the Electrical Department's Bungsar station were completed, except for minor details, the plant capacity being increased from 19,000 to 31,500 kW. Investigation of the Sungei Tangli hydro-electric scheme, near the Ginting Sempah Pass, has been proceeding but has been temporarily delayed because the Drainage and Irrigation Department has had to concentrate its energies on numerous irrigation schemes designed to increase the country's rice production. A preliminary survey of the route of the transmission line has, however, been made, and a 10-ft. path has been cut through the jungle.

Extension of the 33-kV transmission line from Kajang to Seremban, together with the provision of an 11-kV network in the Seremban district, is planned. In Selangor the policy of extending the 33-kV lines to meet the needs of mining and industrial consumers has proved fully justified. The lines are now coming within reach of the more remote parts of the State, and surveys have been undertaken to determine the prospects of supplying electricity on reasonable terms for domestic and small-power use. The technical and practical difficulties of such schemes are, however, considerable. The loads are small and straggling, and as soon as the lines leave the road in nearly all cases an expensive route must be cleared through either jungle or rubber plantations. For certain areas the use of composite high- and low-voltage lines supported on wood poles is being considered. Greater employment of hardwood poles is contemplated, and the investigations of the Forest Research Department point to "Chengai" as being the most durable timber available, and with it no serious trouble from white ants is anticipated.

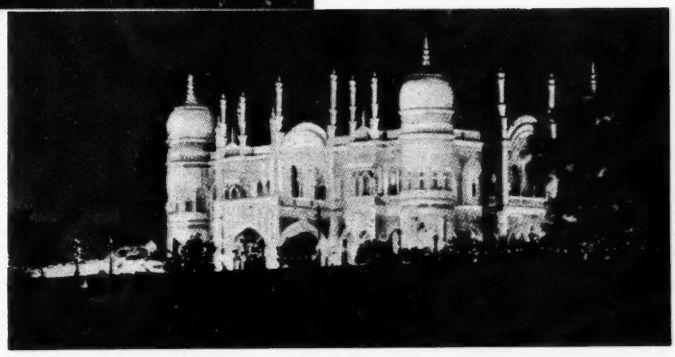




A close-up view of the bucket ladder of a new 1,722-h.p. electrically operated dredge

ABOVE—General view of the turbine room at Bungsar power station, showing the newly installed 12,500 kW set in the foreground

RIGHT—The Astana Mahkota, Klang, floodlit for a State ceremony



The wider use of domestic electrical apparatus by both Asiatic and Eurasian members of the community has recently been marked, and the demand for automatically controlled apparatus has reached unprecedented proportions. The Electrical Department's hiring records show that the thermostatically controlled cooker is much appreciated by consumers, as also are low-loading water heaters. Another popular device is the high-efficiency capacitor type fan, which is said to have "taken Kuala Lumpur by storm." The use of portable air-conditioning plants in bungalows and offices is also spreading rapidly, and it is thought that Malaya, with its humid atmosphere, will soon have most of its homes and offices air-conditioned. Equipment has also been installed in main-line trains.

A move was made during the year to improve wiring methods in the country. Domestic wiring in the Federated Malay States

(*Concluded at foot of next page*)

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ELECTRICITY SUPPLY

Edinburgh and Portsmouth Results. Belfast Shelter Lighting Scheme

Aberystwyth.—15 PER CENT. PRICE INCREASE.—As from the September meter readings an addition of 15 per cent. is to be made to all electricity charges except hire and hire-purchase payments. Mr. F. T. Foulkes, chairman of the Electricity Committee, explained that the undertaking had been run at a loss during the past year.

Alsager.—STREET LIGHTING SCHEME.—The Urban District Council has instructed the Electricity Distribution of North Wales and District, Ltd., to proceed with a modified scheme of street lighting for the district at a cost of £400.

Ashton-under-Lyne.—HIGHER CHARGES.—The Council has endorsed the Electricity Committee's resolution that an addition of 12½ per cent. shall be made on all accounts for electricity not subject to a coal clause, and hire rentals, as from December 1st. In the case of large power accounts subject to coal clause adjustments there will be a 10 per cent. increase with 12½ per cent. on any hire rentals to take effect as from the monthly account period commencing October 1st. Councillor L. T. Wright, chairman of the Electricity Committee, said it was hoped the 12½ per cent. increase would be sufficient at least for the period of the war.

Birmingham.—SLOT METERS AND THE BLACK-OUT.—A recent case at Birmingham in which a fine was imposed for a breach of the lighting regulations draws attention to a possible danger. It was stated that while the lights in a house were on, the slot-meter supply ran out and was not immediately attended to. Later a member of the family inserted a coin in the meter and the lights were restored, including one in an unoccupied room in which the curtains had not been drawn. Mr. F. Forrest, the city electrical engineer of Birmingham, has issued a warning to consumers to see that all switches are off before inserting coins in meters when the supply has run out.

Chester-le-Street.—SHELTER LIGHTING.—The Rural District Council is being asked by Great Lumley Parish Council to light air-raid shelters with electricity or oil lamps.

Edinburgh.—PROFIT DESPITE REDUCED OUTPUT.—The report on the trading of the Electricity Department for the year ended May 28th last is signed by Mr. E. Seddon (who has recently retired) and Mr. J. Eccles as joint managers. They point out that under present conditions comparison with the previous year has not the usual significance as the clouds of war have overshadowed the Department's activities to such an extent as to stultify the normal progress and growth of the undertaking. The cost of materials has been rising, A.R.P. expenditure has constituted a new burden and the sales of electricity have shown a downward trend in all but one of the main uses, while public lighting has virtually disappeared. Nevertheless, by effecting corresponding reductions in the cost of new development work and by the careful control of necessary expenditure the trading solvency of the undertaking has been maintained without its being necessary to raise any of the rates of charge, although how long this fortunate position can continue they are unable to foresee. Total income on revenue account was £1,051,560 as compared with £1,039,489 in the previous year, while working expenses rose from £835,582 to £846,617. The net profit of £36,637 (against £58,081) is placed to reserve. Altogether 222.3 million kWh was sold, a reduction of 3.7 per cent. compared with 1938–39, when the quantity sold was 230.8 million kWh.

Northern Ireland.—AIR-RAID SHELTER LIGHTING.—The *Northern Whig* reports that a complete scheme for the lighting of public air-raid shelters is being prepared by the Belfast city surveyor for the A.R.P. Committee, and when this has been submitted, with an estimate of the cost, the Committee will decide whether or not to proceed with it.

Portsmouth.—NO RATE CONTRIBUTION.—The 1939–40 accounts of the Electricity Department presented to the City Council last week show that after defraying the cost of new meters and their installation, amounting to £16,377, and various items totalling £3,374, there remains a net surplus of £30,105 against £51,332 in the previous year, when a contribution of £27,500 was made in aid of the rates; this year there is no such allocation. A sum of £10,000 is placed to reserve for repairs and renewals postponed owing to war conditions and £13,865 is transferred to the reserve fund, a balance of £6,240 being carried forward. Mr. B. Handley, the engineer and manager, in his report, says that taxation for war purposes has created a situation in which payment in aid of the rates, beyond the £35,862 on the undertaking's assessment, is difficult. The outbreak of war has had a severe effect on output and had it not been for the extensive country area, in which the demand for electricity had increased considerably, the undertaking would have been faced with a serious drop in sales. Apparatus on hire at the end of the year included 13,394 cookers, 13,028 water heaters, 2,964 wash-boilers, and 2,762 radiators. There were also 379 refrigerators out on hire-purchase. Of the 4,505 new connections, 4,319 were for new installations. The number of premises now connected totalled 95,386 out of a possible 106,512. Sales to consumers last year totalled 145.6 million kWh, an increase of 6.1 million kWh.

Rushden (Northants). — LIGHTING RESTRICTION.—The new street lights are to be extinguished earlier. Air-raid wardens and others have complained about the brilliance of the lighting, but it is suggested that there is little cause for apprehension, although a few lights might need alteration.

Swansea.—AIR-RAID SHELTER INSTALLATIONS.—The Emergency Committee is to install electric lighting in various shelters at a cost of £306.

Overseas

Canada.—POWER FOR WAR PRODUCTION.—Power demands from war industries, which at the present rate of increase will absorb the Niagara System's resources by the spring of 1942, compel immediate expansion of the Ontario Hydro-Electric Power Commission's sources of energy, according to a recent statement by the Premier of Ontario, Mr. Mitchell Hepburn. Of the 706,600 HP represented in the new Quebec contracts, delivery is being taken of all but 120,000 HP.

ST. LAWRENCE DEVELOPMENT.—The Ottawa Correspondent of *The Times* reports that the Canadian Cabinet is considering fresh representations from Washington about the treaty for the St. Lawrence seaway, which Mr. Roosevelt is anxious to have signed before the Presidential election. The latest American proposals emphasise the power aspects of the project as calculated to assist the joint defence programme and in official circles in Ottawa the communication from Washington is described as a "big forward step" towards final agreement.

India. — INQUIRY INTO ELECTRICITY CHARGES.—An Advisory Board has been appointed by the Sind Government to discuss alterations in the maximum charges for electricity in Karachi, Hyderabad, Sukkur, Larkana and Mirpurkhas.

Activity in Malaya

(Concluded from page 269)

has been almost universally carried out by the all-insulated t.r.s. surface wiring system, and when the wiring becomes perished and brittle, as eventually it does through exposure to the strong sunlight, accidents may happen. For certain Government quarters it was decided to adopt solid-drawn galvanised conduit; some difficulty was experienced in training the electricians to handle this class of work, but the appearance is much better and additional safety is provided.

TRANSPORT

Glasgow.—MANUFACTURE OF BUS BODIES.—The Parliamentary Committee has considered the question of seeking powers to manufacture bodies for motor-buses and trolley-vehicles, but cannot recommend this course at the moment.

London.—ALDWYCH TUBE AS SHELTER.—The London Passenger Transport Board suspended traffic on the Aldwych-Holborn spur of the Piccadilly Line on Sunday last. It is understood that steps are being taken by the Board in conjunction with the Ministries of Transport and Home Security to convert the line, which is about three-quarters of a mile long, into an air-raid shelter. The tube was inspected by Lord Ashfield and Sir John Anderson last week.

United States.—A CONTRAST IN RESULTS.—Discussing the replacement of street cars by small buses on the lines of the Detroit municipal system, *Mass Transportation* says that the fallacies of the claims made in certain quarters of economies effected by this move have been exposed by the Cleveland Car Riders' Association in a series of reports. Further figures for Buffalo, taken from the annual reports of the International Railway Company, clearly disprove the idea that the small bus is a panacea for the ills that beset many transport undertakings. At Indianapolis the system was modernised with street cars and trolley-coaches: the former operate over 31.5 per cent. of the total mileage and carry 39 per cent. of the passengers, while the latter cover 38.5 per cent. of the mileage and carry 43 per cent. of the passengers. The result has been that in 1939 the revenue was $50,000 more than three years ago, with a small net profit. On the other hand, at Buffalo there have been growing deficits. It is evident, therefore, that the Indianapolis management in selecting large vehicles with electric drive for replacing obsolete street cars has secured far better results both in popular favour and financial benefit than the small-bus programme in the Buffalo area has produced.

NEW TROLLEY COACH SERVICES.—The Des Moines Railway Co. operates 100 miles of route, on which are 90 electric trams, 37 petrol coaches and 31 trolley-coaches. Because of satisfactory operation during 1938 and 1939, the company ordered eight more 44-passenger trolley-coaches for September delivery. They were constructed by the J. G. Brill Co. with American General Electric compound motors and control gear and are being substituted for trams. Four additional trolley-coaches have been purchased from Topeka, so that after this month the number in operation will total 43, exceeding the petrol buses in use. In 1939 the earnings of the entire system decreased by 1 per cent., but one trolley-coach line showed a 5 per cent. increase in earnings over the previous year when service was by trams, and another had a 14 per cent. increase. In the first four months of this year the rest of the system had a 2 per cent. increase in earnings over the same period of 1939. The trolley-coach lines averaged 12 per cent. increase in earnings in the same period.

On July 7th trolley-coach services were inaugurated on three routes at Fort Wayne, the fleet comprising 28 vehicles. Trolley-coach operation is also planned on a further route within the next few months, and others at a later date.

FINANCIAL SECTION

New Companies. Capital Returns. Debenture Charges. Bankruptcies and Liquidations. Reports and Dividends. Stocks and Shares

New Companies Registered

City Road Engineering Works, Ltd.—Private company. Registered September 13th. Capital, £1,000. Objects: To carry on the business of mechanical, electrical, civil, aeronautical, television, radio and general engineers, machine tool makers, &c. Directors: Mrs. E. M. G. Gunst, 66, Harley Street, W.1; and A. E. Deslandes, 105, Winston Road, N.16. Registered office: 210, Upper Thames Street, London, E.C.4.

Carr & Boulanger, Ltd.—Private company. Registered September 16th. Capital £500. Objects: To carry on the business of consulting, mechanical, electrical, civil, chemical, hydraulic, pneumatic, constructional, heating, lighting, sound, ventilating, converting and finishing engineers, iron-founders, &c. The directors are: J. W. H. Carr, 82, Wades Hill, Winchmore Hill, N.21; & D. H. Boulanger, "Winsford," Woodland Rise, Seal, near Sevenoaks. Solicitors: Robertson Martin & Co., 7, King Street, Cheapside, E.C.2.

Companies' Returns

County of London Electric Supply Co., Ltd.—Capital, £16,500,000 in £3,381,925 6 per cent. cumulative preference stock, £3,000,000 4 per cent. cumulative preference stock, £7,082,109 ordinary stock and 118,075 6 per cent. cumulative preference, 1,750,000 preference and 1,167,891 ordinary shares, all of £1. Return dated April 2nd. All stock taken up. £10,754,441 paid on £3,225,000 6 per cent. preference, £3,000,000 4 per cent. preference and £4,529,441 ordinary stock. £2,709,593 considered as paid on the remainder. Mortgages and charges: £8,500,000.

Cable and Wireless, Ltd.—Capital, £30,000,000 in £1 shares. Return dated June 4th. All shares taken up. £1,266,493 paid. £28,733,507 considered as paid. Mortgages and charges, nil.

Dawlish Electric Light & Power Co., Ltd.—Capital, £40,000 in £1 shares. Return dated June 5th. All shares taken up. £40,000 paid. Mortgages and charges, nil.

Weston Electric Lamp Co., Ltd.—Capital, £200 in £1 shares. Return dated June 30th, 1939 (filed March 8th, 1940). All shares taken up. £200 paid. Mortgages and charges: £550.

Yorkshire Woollen District Transport Co., Ltd.—Capital, £550,000 in £1 shares. Return dated April 23rd. 528,000 shares taken up. £220,000 paid. £308,000 considered as paid. Mortgages and charges, nil.

Electricity Distribution of North Wales & District, Ltd.—Capital, £400,000 in £1 shares. Return dated March 29th. All shares taken up. £411,087 paid (£1 on 202,000 and 21s. 6d. on 194,500 shares). £3,500 considered as paid £1 on 3,500 shares. Mortgages and charges: £60,330.

Oriental Telephone & Electric Co., Ltd.—Capital, £900,000 in 300,000 preference and 600,000 ordinary shares of £1. Return dated June 4th. 188,791 preference and 570,199 ordinary shares taken up. £479,906 paid on 188,791 preference and 291,115 ordinary shares. £279,084 considered as paid on 279,084 ordinary shares. Mortgages and charges, nil.

Mortgages and Charges

Sandas Batteries, Ltd.—Debenture, charged on the company's assets, present and future, including uncalled capital, dated August 21st, 1940, to secure £150. Holder: S. Cooper, 7, Bishopscourt, Sheffield.

Holroyd (Glassware & Lighting), Ltd.—Debenture, charged on the company's undertaking and property, present and future, including uncalled capital, dated September 5th, 1940, to secure £1,350. Holder: C. D. N. Butler, Woodside House, Chalfont Heights, Chalfont St. Peter, Bucks.

J. G. Smithson & Co., Ltd.—Mortgage on all moneys due or to become due under certain contracts, dated September 4th, 1940, to secure all moneys due or to become due from the company to Lloyds Bank, Ltd., not exceeding £1,000.

D. Lloyd Lewis, Ltd.—Satisfaction to the extent of £500 on August 30th, 1940, of debentures authorised May 8th, 1934, and registered May 11th, 1934. (According to the register of mortgages, the debentures registered May 11th, 1934, originally secured sums not exceeding £2,500.)

Receivers Appointed

Holdgate & Commin (Electrolier), Ltd.—A. J. Goulden, 55, Brown Street, Manchester, was appointed receiver on September 6th, 1940, under powers contained in debenture dated August 8th, 1939.

Kenneth Bell, Ltd.—J. A. Cox, engineer, 500, Abbey House, Westminster, S.W., was appointed receiver and manager by Order of Court dated September 6th, 1940.

Company Liquidations

Traffic Radio Syndicate, Ltd.—Meetings, pursuant to Section 244 of the Companies Act, 1929, at Merthyr House, James Street, Cardiff, on October 19th to receive an account of the progress of liquidation by the liquidator, Mr. J. Pearson-Griffiths.

Electrology, Ltd.—Winding up voluntarily. Liquidator, Mr. E. C. Tilly, 43, Gower Street, London, W.C.1. Particulars of claims to the liquidator by October 31st. This notice is purely formal, all creditors of the company have been or will be paid in full.

Bankruptcy Proceedings

H. Beaumont, electrical engineer and radio dealer, 207, Luck Lane, Paddock, Huddersfield.—Public examination November 6th, at the County Court, Huddersfield.

T. Maund, electrical engineer, 37, Earle Road, Bramhall, Chester, lately carrying on business at 80, Wellington Road North, Heaton Morris, Lancs, as the Beacon Electrical Co.—Receiving order made September 12th on a creditor's petition.

S. H. Holly, electrician, 4, South Street, Wareham.—Application for discharge to be heard on October 14th at the Law Courts, Bournemouth.

R. J. Horton, electrical engineer, 204, Coldharbour Lane, Brixton, London, trading at South Croydon and Coulsdon.—Trustee, Mr. C. Latham, 185–8, High Holborn, W.C.1, released August 20th.

E. C. Johnson, lately residing at 37, Park Drive, Barlaston, and carrying on business in co-partnership with J. A. Sheward as Edstan Electric at 20, Market Street, Hanley, Stoke-on-Trent, and 40, London Road, Newcastle-under-Lyme (separate estate of E. C. Johnson).—First and final dividend of 20s. in the £, payable at 12, Lonsdale Street, Stoke-on-Trent.

Reports and Dividends

The Bagdad Light and Power Co., Ltd., announces that it is impossible to submit a report and balance sheet for 1939 at present. Many of the company's books are kept at Brussels and the audit was in progress there when the invasion of Belgium took place. A director, Mr. G. Grandchamps, was able to leave Brussels with the books and open an office in Paris. He and Mr. Pirard were last heard of in unoccupied France at Vichy. The whereabouts of Baron Paul de Launoit is unknown. As these three directors are, it is believed, still in enemy territory, they cannot be considered as being any longer members of the board. The management agreement with "Engetra" must also be regarded for the time being as having ended.

The three remaining directors consider that they will be able to carry on the business of the company effectively, with the assistance of the London secretary, Mr. H. Pryor (of Hay, Akers and Hays).

The Power Corporation of Canada reports a gross revenue to June 30th from investments and fees of $1,774,987, an increase of $67,959 as compared with the previous year, and a net revenue of $1,453,177, an increase of $54,570. After providing for debenture and other interest and dividends on the preferred and common shares there was $83,570 which was transferred to surplus account. The regular dividends on the 6 per cent. cumulative preferred and 6 per cent. participating preferred shares are paid. An interim dividend of 30 cents per share on the no par common shares was paid on December 21st, 1939, and a similar amount on June 29th, making 60 cents per share (same).

Marconi's Wireless Telegraph Co., Ltd., is maintaining its interim ordinary dividend at 3½ per cent., less tax.

The Midland Counties Electric Supply Co., Ltd., is again paying an interim dividend of 2½ per cent. on the ordinary stock.

The Lancashire Electric Light & Power Co., Ltd., has declared an interim dividend of 2½ per cent. (same).

The Watford Electric & Manufacturing Co., Ltd., is paying an interim dividend of 5 per cent. (unchanged).

Stothert & Pitt, Ltd., are maintaining their ordinary dividend for the year to June 30th at 10 per cent., but the cash bonus is cut from 5 per cent. to 2½ per cent.

TRADE MARK APPLICATIONS

AMONG recent applications for British trade marks are the following, objections against any of which may be entered within one month from the dates mentioned.

September 11th.

XELEX. No. 612298. Class 2 (IV). Synthetic resins sold in the form of sheets, rods, bars, films, filaments, threads, dough, power and liquid. Xelex Products, Ltd., 12 Clarges street, Piccadilly, W. 1.

ELASTA. No. 612446. Class 11 (IV). Electric lamps other than for surgical and curative purposes. Pope's Electric Lamp Co., Ltd., 5 Earnshaw street, New Oxford street, W. C. 2.

September 18th.

RAYTHEON. No. 611666. Class 9 (IV). Electric discharge tubes and photo-electric cells. Raytheon Production Corporation, Newton, Mass., U.S.A. (British representatives, Marks & Clerk, 57-58 Lincoln's Inn Fields, W. C. 2.)

CHLOROVENE. No. 611774. Class 17 (IV). Substitutes containing chlorine compounds for guttapercha, indiarubber and balata, electrical insulating materials, etc., F. A. Hughes & Co., Ltd., Abbey House, Baker street, N. W. 1.

INFORMATION DEPARTMENT

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, &c., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the following:—

GENERAL INDUCTANCE CO. LTD. makers of "Gilda" hairdryers (present address).

N.S. 10 "PHONETTE" wall telephone.

STOCKS AND SHARES

TUESDAY EVENING.

STOCK Exchange business is being limited by the exigencies of the invasion of London by enemy aircraft. As things are now, whenever the air-raid warning is given, Stock Exchange members troop out of the House to find shelter in adjacent buildings. It might have been thought that interruptions of this kind would have an unfavourable effect upon quotations. In point of fact, quotations are not only well maintained, but, when they move at all, which is not very often, it is usually in the upward direction.

The gilt-edged stocks show a surprising degree of strength; surprising, because of the meagreness of the business which is being handled. The home railway market makes an exception to the general firm tendency noticeable elsewhere: Southern Railway stocks have been weak. London Passenger Transport issues have hardly changed. It has been found necessary to omit our table of share prices this week, but we hope to resume it in our next issue.

Electricity Supply Shares

The market in Home Electricity Supply shares is so firm as to compel the view that shareholders have no intention of parting from their interests simply because there is talk of invasion and a continuance of aerial attack. The companies are declaring their regular interim dividends, and this in itself has a fortifying effect which is noticeable in the way that prices stand up to the present crisis. Up to now, none of the properties of the larger companies has been damaged, so far as is known, and the immunity from loss on this account no doubt has something to do with the strength shown by prices of the ordinary shares. It may be doubted whether, if one or other of the companies did suffer to any appreciable extent, this would exercise any material influence upon the market in the shares. The jobbers in that department find there are constantly fresh buyers coming forward prepared to take shares in lines varying from 100 to 1,000. The buying, as the Stock Exchange says, is better than the selling. In several cases, the supply of shares available is no more than retail.

Business Disorganisations

Most people have had, and are having, personal experience of the disturbances in communication services; delays in deliveries of telegrams and of letters; interruptions to telephone talks and so on. To every business these departures from the normal routine are annoying, to say the least of it, cheerfully as they are suffered as being inevitable under war conditions. Such handicaps make their influence felt in matters relating to the handling of Stock Exchange business, the day-to-day conduct of which is liable, also, to abrupt suspension when the sirens start to sing and the Stock Exchange is evacuated by members and their clerks. The client is, as likely as not, unaware of this regulation, framed for the safety of everyone concerned. He, not receiving the expected contract for business done, may be inclined to make critical inquiries.

The Reason Why

To him it may be pointed out that, directly an air-raid warning is received by watchers on the roof of the Stock Exchange, the report is telephoned to the official department that deals with the klaxons placed in the Stock Exchange, and whose clamorous discord blares out the unwelcome news. To empty the Stock Exchange takes three minutes: to refill it, after the "All Clear" takes two minutes. But the interval may be a protracted one: the markets may have closed, as they automatically do at 2 o'clock, before the "All Clear" comes through. For the broker to deal later, by telephone, may be found impracticable. The upshot of it is that the client's order is not executed; no contract is forthcoming; explanations by post do not arrive, and the client is left with a sense of irritation. Thanks to the improvement that has already been made in the postal service, a smoother running of Stock Exchange business is gradually being restored.

Foreign Currency Stocks

While fluctuations are now permitted in the prices of stocks and shares, the nominal denominations of which are quoted in foreign currency, there is no sign of unbending in the attitude of the Treasury as regards dealing in these securities. The British holder of American Telephone and Telegraph shares, to take one example, who had lodged his shares for safe custody with his bank, is doubtless aware that the certificates have been sent, without his being consulted, to Canada for shelter. The Treasury has the call of the shares up to the point at which they can be taken over, compulsorily, from the proprietor, at the price of the day. If the shares are sold in New York, the money goes to the Bank of England, who will retain the dollars, and pay the holder in sterling. Sale of the shares to a resident in this country is allowed only under very exceptional conditions. Until a week ago, no changes had been made since June 17th last in the prices of the affected securities, but these are now brought into line with market values ruling in New York and other centres. A question often put to the Treasury asks why the latter does not either take over these stocks without further hesitation or, as an alternative, issue certificates of deposit against each lodgment of shares, and allow dealings to take place in such certificates. American "Tel. & Tel." shares are 10 points down at 190. International "Tel. & Tel." are about 3.

Cable and Wireless Stocks

Marconi's Wireless has declared an interim dividend of 3½ per cent., the same as that of last year, when 7 per cent. was paid for the full period. The price of the shares stands at 14s. 6d., but they rarely change hands. All except a very small amount of the company's capital is controlled by Cable and Wireless (Holding). The figures of the Cable and Wireless operating company, published last week, aroused some slight disappointment. They led to a falling-off of the demand, small though that was, for Cable & Wireless (Holding) preference and ordinary stocks. The prices remain at 86 and 50 respectively, and the 4 per cent. funded income stock holds its ground at 97, the same price as that of the 4 per cent. debenture stocks in the Eastern Telegraph, Eastern Extension and Western Telegraph companies.

Crompton Parkinson

The Crompton Parkinson financial year ends with this month: interest is now speculating as to the probable dividend for the final half of the twelve-month. The interim dividend of 7½ per cent. was at the same rate as that paid for the corresponding period of 1938-9, the total being made up to 20 per cent. This went against 30 per cent. in the preceding year. The dividend of 12½ per cent. in 1937 was accompanied by a scrip bonus of 40 per cent. in "A" ordinary shares, followed, a year later, by a 50 per cent. bonus of the same class of shares. Of the "A" ordinary capital, there is now in issue £1,079,442, quoted as stock in units of 5s. The ordinary stock amounts to no more than £150,000, quoted at the same price as the "A" stock. It is thought that the Company will repeat last year's 20 per cent. distribution, a rate which would afford a yield of £7 5s. 6d. per cent. upon the shares at to-day's level.

Gilt-Edged Preference

Crompton Parkinson guarantees the 5 per cent. dividend on British Electric Transformer preference. These shares can be regarded as gilt-edged in their class, because to satisfy the £9,531 required for annual service of the dividend, the Company's last-published accounts showed £79,000 available. There are 900 shares on offer in the market at 22s., the modest yield of 4½ per cent. being due to the high character of the security. The dividend is paid once a year, on December 31st. Another generously-covered preference security is the West Riding Automobile 6 per cent. issue, of which 5,000 shares are on offer at 25s. 6d. At this price the yield is £4 14s. per cent. Dividends are due in January and July. The annual dividend service requires £9,021; the last accounts showed £126,400 available to meet it. The 8 per cent. participating shares of Tilling and British Automobile have received the full 10 per cent., to which their participation entitles them, for each of the past ten years. The £20,000 that the dividend absorbs was provided out of £488,400 in last year's profits. A few hundred shares are in the market at 42s. ex the dividend recently paid, and the return comes to 4¾ per cent. on the money.

Some investors look askance at fixed-dividend shares that stand higher than a very small premium above the nominal value. Such investors prefer shares at a discount. Bristol Tramways 4 per cent. preference are an example. These £1 shares can be obtained at 18s. 6d., are amply secured as to dividend, and return the relatively low yield of £4 6s. 6d. per cent. on the money.

County of London Electric

The ordinary shares in the London Electricity Supply group that give the highest yield at present prices are County of London. These are on offer at 28s. 0d. ex the interim dividend of 3 per cent. Of recent years the Company has paid 10½ per cent. per annum, 3 per cent. interim and 7½ per cent. final. At 28s., this 10½ per cent. dividend would afford 7½ per cent. on the money. Two of the County of London subsidiaries, the Bournemouth and Poole and the Richmond (Surrey) Electricity Supply companies have lowered their interim dividends by 1 per cent. in each case. The present price of County of London shares suggests a possible reduction in the final dividend for the year. As a contrast, Edmundsons Electricity Corporation may be cited; the price is 23s. and, on the present-paid dividend of 6 per cent., the yield is barely 5½ per cent., the inference here being that the Corporation is expected to maintain its 6 per cent. dividend. It is, however, very difficult to estimate what the final dividends for this year on any industrial shares are likely to be.

NEW PATENTS

Electrical Specifications Recently Published

Compiled by a firm of chartered patent agents. The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1937

30268. "Anti-dazzle device for protection against strong sources of light in night traffic." F. Mayr-Melnhof. November 11th, 1936. (525493.)

1938

23569. "Television method, and arrangement for carrying out the same." Radioakt.-Ges. D. S. Loewe. August 12th, 1937. (525543.)

30528. "Calculating installations and apparatus." Standard Telephones & Cables, Ltd. (L. Kozma and J. Kruithof). November 21st, 1938. (525329.)

30530. "Electrically-operated calculating apparatus." Standard Telephones & Cables, Ltd. (L. Kozma and J. Kruithof). November 21st, 1938. (525330.)

34064. "Starting systems for alternating-current synchronous machines." British Thomson-Houston Co., Ltd. November 24th, 1937. (525546.)

37271. "Electronic amplifier." Farnsworth Television, Inc. January 5th, 1938. (525402.)

37346. "Gas-turbine plant." G. Jendrassik. December 24th, 1937. (525550.)

1939

2023. "Electrical superheterodyne frequency-changers." General Electric Co., Ltd., A. I. F. Simpson and L. C. Stenning. January 20th, 1939. (Cognate application, 7653/39.) (525404.)

2440. "Automatic valve device." Callender's Cable & Construction Co., Ltd., and A. B. F. G. Richardson. January 24th, 1939. (525555.)

2466. "Telephone and other electric wave transmission systems." R. J. Halsey. January 24th, 1939. (525557.)

4738. "Tuning device for radio receivers." N. Hansen. July 25th, 1938. (525405.)

5261. "Press-button tuned radio receivers." E. K. Cole, Ltd. and R. Kemp. February 17th, 1939. (525611.)

5346. "Protective devices for electric transmission systems." British Thomson-Houston Co., Ltd. (Shibaura Engineering Works, Ltd.) February 17th, 1939. (525334.)

5406. "Electric hoists." Yale & Towne Manufacturing Co. October 20th, 1938. (525340.)

5413. "Television facsimile telegraph and like synchronising systems." G. Guanella. February 17th, 1938. (525342.)

5415. "Crystal-controlled electron-discharge tube oscillation generators." Fides Ges. für die Verwaltung und Verwertung von Gewerblichen Schutzrechten. February 17th, 1938. (525343.)

5416. "Photo-electron-emissive electric cells." Fides Ges. für die Verwaltung und Verwertung von Gewerblichen Schutzrechten. February 17th, 1938. (525344.)

5466. "Thermionic valve circuits." L. E. Ryall. February 18th, 1939. (525411.)

5489. "Illuminating devices." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. February 21st, 1938. (525350.)

5526. "Radio-transmitting systems." F. G. Kear. February 20th, 1939. (525359.)

5529. "Radio-transmitting apparatus." G. L. Davies. February 20th, 1939. (525360.)

5554. "Electrically-operated variable-stroke reciprocators and pumps." W. L. Spence. February 20th, 1939. (Cognate application, 1354/40.) (525363.)

5568. "Process and apparatus for the electro-deposition of tin alloys." S. W. Baier and D. J. MacNaughtan. February 20th, 1939. (525364.)

5591. "Anodes for lead accumulators." A. Reiffer. February 23rd, 1938. (525374.)

5600. "Thermionic valves adapted for operation at very high frequencies." M-O Valve Co., Ltd. and M. R. Gavin. February 20th, 1939. (Cognate application 1450/40.) (525378.)

5601. "Luminescent materials and their manufacture." General Electric Co., Ltd. and A. H. McKeag. February 20th, 1939. (Addition to 495706 and 509858.) (525379.)

5604. "Devices having sealed vitreous envelopes through which pass electric conductors." General Electric Co., Ltd. and R. L. Breadner. February 20th, 1939. (525380.)

5610. "Electric fuse contacts." British Thomson-Houston Co., Ltd. February 19th, 1938. (525383.)

5611. "Electric choke coils." British Thomson-Houston Co., Ltd. February 19th, 1938. (525384.)

5612. "Systems for supplying fluids under pressure." British Thomson-Houston Co., Ltd. February 19th, 1938. (525384.)

5613. "Automatic speed-control systems for electric motors." British Thomson-Houston Co., Ltd. February 19th, 1938. (525563.)

5619. "Beacon system." Holophane Ltd., and S. English. February 20th, 1939. (Cognate application, 19447/39.) (525385.)

5637. "Electro-magnetic relays." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. February 22nd, 1938. (525417.)

5638. "Electric discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. February 22nd, 1938. (525418.)

5639. "Tubular electric incandescent lamps or discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. February 23rd, 1938. (525419.)

5647. "Electrical relay devices." D. C. Gall. February 20th, 1939. (525421.)

5662. "Apparatus for short-wave therapy and the like." C. R. Burch and Metropolitan-Vickers Electrical Co., Ltd. February 20th, 1939. (525425.)

5682. "Electrical pick-ups with vibrating armature." O. Steidinger and S. Steidinger. December 17th, 1938. (Cognate application, 5683/39.) (525431.)

5699. "Insulation of metallic parts of apparatus." R. Bosch Ges. March 11th, 1938. (525433.)

5712. "Magnetic separators." R. Greaves. February 21st, 1939. (525390.)

5721. "Electric fuses." W. Sanders & Co. (Wednesbury), Ltd., E. B. Manion and G. H. Bayliss. February 21st, 1939. (525438.)

5737. "Ferraris type of induction meters." M. Wiesengmend and E. Szanto. February 21st, 1939. (525441.)

5767. "Devices wherein cathode-rays excite luminescent materials." General Electric Co., Ltd. (Patent-Treuhand Ges. für Elektrische Gluhlampen). February 21st, 1939. (525445.)

5768. "Coaxial lead-in conductors for electric vacuum tubes." C. Lorenz Akt-Ges. February 21st, 1938. (525446.)

5769. "Electrically heated vulcanisers." Dill Manufacturing Co. February 23rd, 1938. (525447.)

5775. "Luminairs." Holophane, Ltd. (T. W. Rolph.) February 21st, 1939. (525450.)

5777. "Electric motor control systems." British Thomson-Houston Co., Ltd. February 22nd, 1938. (525451.)

5778. "Means for heating parts of aircraft." British Thomson-Houston Co. Ltd., and L. J. Clark. February 21st, 1939. (525452.)

5780. "Construction of cooling-towers or similar structures." L. G. Mouchel & Partners, Ltd., and A. Stubbs. February 21st, 1939. (525453.)

5788. "Electric motor control systems." English Electric Co., Ltd., H. S. Pound-Corner, H. B. Sedgfield and E. A. Binney. February 21st, 1939. (525452.)

5794. "Wireless apparatus for the simultaneous reception of a plurality of signals." M. Wallace. February 21st, 1938. (525393.)

5802. "Waterproof jacket for electric flashlights." L. Mellersh-Jackson. (United States Electric Manufacturing Corporation.) February 21st, 1939. (525457.)

5804. "Electric water-heaters." L. P. Haussauer. February 21st, 1939. (525459.)

5807. "Connectors for electrical conductors." V. G. Manufacturing Co., Ltd., and F. M. Van Gelderen. February 21st, 1939. (Cognate application 7436/39.) (525460.)

5816. "Two-way telephone and telegraph circuits." Telefunken Ges. für Drahtlose Telegraphie. February 22nd, 1938. (525462.)

5852. "Table lamps." Mintons, Ltd., and A. J. Campbell. February 22nd, 1939. (525482.)

5853. "Thermal switch apparatus for electric fire-alarms." E. Winfield. February 22nd, 1939. (525483.)

5879. "Means for use in the manufacture of electrically welded wire frames." Wellington Concrete Pipe Co., Ltd. February 24th, 1938. (525485.)

5904. "Steam valves." K. Baumann and Metropolitan-Vickers Electrical Co., Ltd. February 22nd, 1939. (Cognate application, 7861/39.) (525491.)

5905. "Ignition systems, and magneto-electric machines therefor." British Thomson-Houston Co., Ltd., and R. T. Coe. February 22nd, 1939. (525492.)

5916. "Electric cables." Callender's Cable & Construction Co., Ltd., and R. W. Lunt. February 22nd, 1939. (525497.)

5921. "Oil-insulated transformers." Allmänna Svenska Elektriska Aktiebolaget. February 28th, 1938. (525499.)

5925. "Spraying nozzles suitable for water-cooling towers." L. G. Mouchel & Partners, Ltd., and P. J. Gerard. February 22nd, 1939. (525550.)

5946. "Engine-starter drives." Bendix Aviation Corporation. February 24th, 1938. (525504.)

5947. "Magneto generators." Bendix Aviation Corporation. February 26th, 1938. (525505.)

5978. "Electromagnetic circuit-breakers and the like." Whipp & Bourne, Ltd., and F. Whipp. February 23rd, 1939. (525,510.)

5988. "Electric furnaces." Birmingham Electric Furnaces, Ltd., and A. G. E. Robiette. February 23rd, 1939. (525568.)

5989. "Heat-resistant parts of furnaces." Birmingham Electric Furnaces, Ltd., A. G. E. Robiette, and P. F. Hancock. February 23rd, 1939. (525513.)

6014. "Apparatus and systems for the photographic recording of sound." O. K. Kolb. February 23rd, 1939. (525571.)

6031. "Method of and apparatus for regulating a condition affected by variations in the rate of supply and/or demand for a fluid." Igranic Electric Co., Ltd. (February 23rd, 1938. (525574.)

6034. "High-pressure mercury-vapour electric discharge tubes." Quarzlampen Ges. February 25th, 1938. (525465.)

6055. "Electric plug-and-socket connections." G. Becker, Ltd., and T. W. Guthrie. February 23rd, 1939. (525578.)

6067. "Method and apparatus for the remote control of wireless receivers and other apparatus." A. R. Fokerd. February 23rd, 1939. (525613.)

6070. "Means for electrically heating pipe-lines." E.I. du Pont de Nemours & Co. February 23rd, 1938. (525584.)

6071. "Means for electrically heating pipe-lines." E. I. Du Pont de Nemours & Co. February 23rd, 1938. (525585.)

6079. "Television-reproducing cathode-ray tubes." Marconi's Wireless Telegraph Co., Ltd., L. M. Myers and A. T. Starr. February 23rd, 1939. (525616.)

6089. "Electric discharge devices." British Thomson-Houston Co., Ltd. February 23rd, 1938. (525618.)

(*Continued on next page.*)

CONTRACT INFORMATION

Particulars of work for which tenders are invited, contracts placed, and building schemes promising work for electrical contractors and traders

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses. Further details of items marked with an asterisk can be obtained from the Department of Overseas Trade (Inquiry Room), Great George Street, London, S.W.1.

Australia. — SYDNEY. — October 24th. County Council. One 50,000-kW steam turbo-alternator set for the Bunnerong power station. (T. 16057/40.)*

MELBOURNE.—State Electricity Commission. October 15th. 4,000 ft. of cable for use on a three-phase 6.6-kV system. (T. 21227/40.)*

Birkenhead.—September 30th. Mersey Railway Co. Stores, including electrical sundries, bakelite lampholders, &c. Particulars from R. Varley, general manager and engineer, Central Station. Samples may be viewed on September 23rd and 24th.

Birmingham.—September 27th. Electric Supply Committee. Storage batteries and charging equipment. (September 6th.)

Edinburgh.—September 27th. Electricity Department. Installation of electric lighting in farm buildings at Bangour Farm, West Lothian. Specifications (£1 1s.) from the Engineer's Office, Dewar Place, Edinburgh.

Manchester.—October 10th. Electricity Committee. Supply, delivery and erection at substations during twelve months ending December 31st, 1941, of three-phase, four-wire, 400/230 V, AC switchgear. (See this issue.)

New Zealand. — WELLINGTON. — October 8th. Public Works Department. 20,000-kVA synchronous condenser with control and protective equipment. (T. 21199/40.)* Four 2,500-kVA transformers or alternatively eight 1,677-kVA transformers. (T. 21197/40.)*

October 15th. 66-kV outdoor switchgear and steelwork for Winton substation. (T. 21206/40.)*

Public Works Department. October 22nd. Transformers and relays.

October 29th. Two motor-driven pumps and equipment. (T. 21604/40.)*

November 5th. 110-kV gang-operated outdoor type switchgear. (T. 21700/40.)*

Salford.—September 30th. Corporation. Three-phase oil-immersed power transformers. (September 20th.)

South Africa.—PRETORIA.—Union Tender and Supplies Board. October 3rd. Distribution boards, switches and fuses, and switch boxes. (T. 21239/40.)*

October 24th. Three batteries (twenty-six 600 Ah cells each). (T. 21552/40.)* Miscellaneous electrical requisites. (T. 21549/40.)*

October 10th. Public Works Department. Laundry machinery, including electric motors, for Krugersdorp Mental Hospital. (T. 21352/40.)*

One 15-kW Diesel engine lighting plant for the Agricultural College, Glen, O.F.S. (T. 21351/40.)*

CAPE TOWN.—October 8th. Electricity Supply Commission. Two 2,000-kVA transformers. (T. 21222/40.)*

November 12th. Two 300-kVA. three-phase transformers. (T. 21801/40.)*

PORT ELIZABETH.—October 10th. City Electrical Engineer's Department. Water tube boiler. (T.Y. 21035/40.)*

PORT ELIZABETH.—October 24th. City Electrical Engineer's Department. Transformers, low-voltage units, &c. (T.Y. 21558/40.)*

JOHANNESBURG.—October 19th. City Council. Electric lamps. (T. 21542/40.)*

October 24th. Public Works Department. L.v. underground cable. (T.Y. 21433/40.)*

October 14th. Four switchboards and two 400-kVA transformers. (T. 21795/40.)*

Stoke-on-Trent.—October 9th. Electricity Department. Replating battery. (September 20th.)

Straits Settlements.—SINGAPORE.—November 11th. Municipal Electricity Department. Three 300-kVA and five 500-kVA static transformers. (T. 1826/40.)

Orders Placed

Exeter.—Electricity Committee. Recommended. Coal-handling plant (£10,934). —Fraser & Chalmers, Ltd.

London.—ISLINGTON.—Electricity Committee. Accepted. Switchgear (£4,104).—Electric Construction Co., Ltd.

Newcastle - on - Tyne. — City Council. Accepted. Electrical repairs to houses during the next six months (£150).—Graham Berrie.

Swansea. — Electricity Committee.—Accepted. Boiler auxiliary switchgear (£10,211). Met.-Vickers Electrical Co., Ltd. Arrangements made with the undermentioned contractors for the duplication of their existing contracts at the same prices as those agreed for their existing contracts, subject to variations throughout the contract periods resulting from increased costs of materials, transport and labour from the date of their original quotations:—Brush Electrical Engineering Co., Ltd.; Custodis (1922), Ltd.; International Combustion, Ltd.; Lodge-Cottrell, Ltd.

Paisley.—Corporation. Accepted. Underground cabling (£1,097, with provision for a time and material rate plus 15 per cent. for extra work, in connection with River Cart lighting). A. M. Spiers & Co.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Alloa.—Shelters (36) for Town Council; James Phillip, contractor, Tillicoultry.

Bentley (Yorks).—Domestic communal shelters (£30,000); R. N. Penlington, surveyor, Council Offices, Bentley, near Doncaster.

Biggar (Lanarkshire).—Reconstruction and extension of Hatfield Mansion House; Robert Ewan, architect, 50, Wellington Street, Glasgow, C.2.

Birmingham.—Additions to works for Newey & Taylor, Ltd.; E. McKie, architect, Norwich Union Chambers.

Blyth (Northumberland).— Communal shelters for Town Council; W. M. Wilson, builder, Cambois, Blyth, and George Potts, builder, Blyth.

Bromsgrove.—Domestic shelters for U.D.C.; G. Nokes & Sons, builders, 293, Lordswood Road, Birmingham, 17.

Carlisle.—Domestic communal shelters (£43,086) and shelters at City General Hospital and Nurses' Home; P. Dalton, city surveyor, 18, Fisher Street.

Chester.—Domestic communal surface shelters (£18,311); C. Greenwood, city surveyor, Municipal Buildings.

Chesterfield.—Sports Stadium, Brimington; W. Aland, 19, Romney Avenue, South Shore, Blackpool.

Clayton-le-Moors.—Domestic communal shelters (£10,000); T. W. Broad, surveyor, Council Offices, Clayton-le-Moors, near Accrington.

Coventry.—Junior and infants' schools at Canley (£33,800) and at Cheylesmore (£34,000); D. E. E. Gibson, city architect, 1A, Warwick Row.

Darley Dale.—Extensions to Sydnope Hall; Henry Boot & Sons, Ltd., builders, Banner Hall Cross, Sheffield.

Darlington.—Washing and drying sheds for J. Shewell & Co. (Successors), Ltd., Darlington.

Concrete works, for Riley and Neate, Ltd.

Further school shelters (£5,053); borough engineer.

Dewsbury.—Police garage for Watch Committee; M. H. Forward, borough architect, Town Hall.

Doncaster.—Public shelters for R.D.C.; J. A. Williams, surveyor, Public Offices, Nether Hall, Doncaster.

Additional storey to central fire station; F. O. Kirby, borough engineer, 2, Priory Place.

Glasgow.—Extension to tea warehouse for Scottish Co-operative Wholesale Society, Ltd.; S.C.W.S. Architectural Department, 119, Paisley Road, Glasgow.

Reconstruction and additions to works of J. & T. Stevens & Co., Ltd.; John Baird & Thomson, architects, 150, Holland Street, Glasgow, C.2.

Three cleansing stations (£5,000); John Train & Co., Ltd.

Grantham.—Houses on Dysart Road site for Town Council; R. Hustwayte & Co., builders, Haydn Road, Sherwood, Nottingham.

Liverpool.—Village Assembly Hall at Netherton; secretary, Residents' Association, Netherton, near Liverpool.

Manchester.—Buildings for Belle Vue (M/c) Ltd.; Graves & Ellerton, architects, 80, Mosley Street.

Church Hall, Charlestown Road, Blackley; Rev. Luke Farrelly, The Presbytery, St. John Bosco, Blackley.

Police and fire station and A.R.P. centre; G. Noel Hill, city architect, Town Hall.

Works additions for Lindsay & Williams, Ltd.; Wrathmell & Blackshaw, architects, St. Peter Square, Stockport.

Additions for Lanes Coachways, Ltd.; G. Bullimore, architect, 5, Cannon Place, Hampstead, London, N.W.3.

Middlesbrough.—Refuge accommodation at several schools; Cecil Gorman, borough engineer, Town Hall.

Ormskirk.—Public shelters in eight townships near Liverpool for West Lancashire R.D.C.; R. Rosbotham, surveyor, Council Offices, Derby Road.

Portmadoc.—Public shelters for U.D.C.; E. I. Pryce, surveyor, Town Hall.

Redditch.—100 houses, Studley Road, Greenlands Estate (£44,755) for Town Council; S. J. Smith & Co. (Bidford), Ltd., builders, Corporation Street, Birmingham.

Sheffield.—Works additions, Spring Street; A. T. Bescoby & Sons, printers, Spring Street.

Skegness.—Communal and public shelters for U.D.C.; R. H. Jenkins, surveyor, Council Offices, Ida Road.

Stockport.—Junior and Infants' School, Broadstone Road South, Reddish, for Education Committee; Cruickshank and Seward, architects, 16, Princess Street, Manchester, 1.

Stockton-on-Tees.—Conversion of premises into factory for Imeson and Finch, Ltd.; G. P. Stainsby, architect, 25, High Street, Stockton.

New Patents *(Concluded from p. 273)*

6090. "Electric discharge devices." British Thomson-Houston Co., Ltd. February 23rd, 1938. (525619.)

6092. "Supply of direct-current electric arcs." Hermes Patentverwertungs-Ges. February 23rd, 1938. (525589.)

6101. "High-tension electric circuit-breakers." C. H. Flurscheim, G. W. Davidson, and Metropolitan-Vickers Electrical Co., Ltd. February 23rd, 1939. (525622.)

6109. "Means for fixing cartridge fuses to fuse carriers." W. T. Henley's Telegraph Works Co., Ltd., and T. Young. February 23rd, 1939. (525642.)